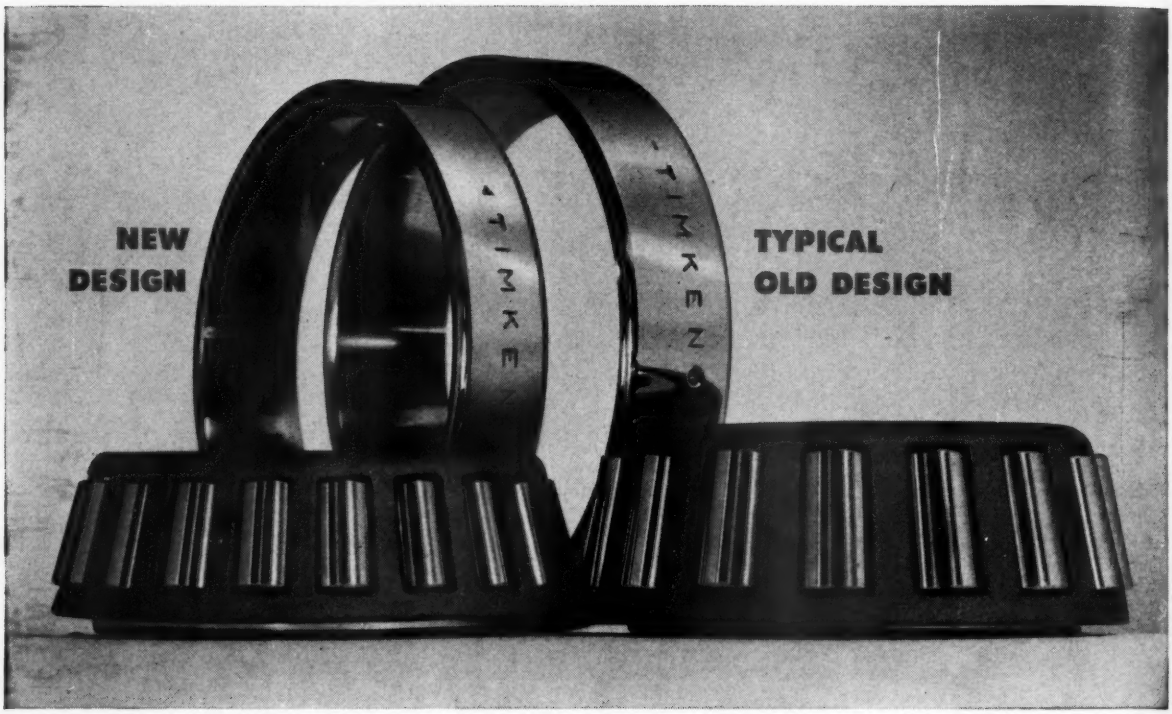
Mining CONGRESS JOURNAL

AUGUST
1955

New TIMKEN® conveyor idler bearings save money, space, weight



Two sizes, 3/4" and 1 1/4", redesigned to give you new economy

THE Timken Roller Bearing Company announces two new tapered roller bearings that cost less than the Timken® bearings now used in heavy-duty conveyor idlers. They are substantially reduced in width and outside diameter, compared to previous designs of the same bore sizes.

The new bearings offer you two big opportunities: 1) Savings through redesign of present tapered roller bearing applications and 2) advantages of Timken tapered roller bearings for new applications at minimum cost.

With the new Timken bearings you'll get all the proven advantages of Timken bearings for conveyor idlers, but at lower cost than ever. Timken bearings are geometrically designed for true rolling motion, and made with great accuracy to live up to their design.

Full line contact between rollers and races gives Timken bearings the high load capacity you need in heavy-duty conveyor applications. And Timken bearings aren't just lubricated for "life", but lubricated yearly, or as conditions require, to insure long life. Fresh lubricant ends any chance of gummy, sticky, jammed bearings.

Auxiliary parts for the new Timken bearings are available now from the Timken Company and other suppliers. If you haven't seen the new Timken bearings, call your Timken Company representative or write: The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN ... your number 1 bearing **VALUE**

TRADE-MARK REG. U. S. PAT. OFF

TAPERED ROLLER BEARINGS

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

LOOKING FOR WAYS TO SAVE MONEY? TRY THIS ONE:

If you're not already using "National" brushes on rotating d-c equipment throughout your mine or mill, prove to yourself that this traditionally dependable brush line can effect the following savings for your department:

- **Longer Brush Life** – "National" brushes give you the most hours of trouble-free service consistent with other important performance factors. National Carbon research is continually at work on this and other features of "National" brushes.

- **Lower Maintenance** – Often much more important than frequency of brush replacement is commutator condition – a direct result of brush performance. The excellent commutating ability and low friction of "National" brushes contribute to low-cost commutator care.

- **Uniformity** – Brush quality is a link in the chain of dependability upon which uninterrupted service of your equipment depends. National Carbon's inspection procedure is designed to assure you of the same uniformly high quality year after year, from box to box and shipment to shipment.

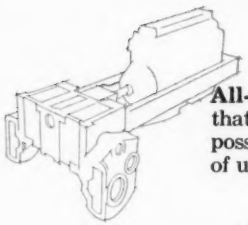
Brush selection is neither a small nor a simple thing. Install "National" brushes in accordance with recommendations of a National Carbon representative. Then expect and *get* the lowest overall brush cost you ever had!

Are you getting the "Brush Digest"? Many thousands of this free, serialized, motor maintenance course are being distributed to their men by electrical and maintenance supervisors. Write for your copies today!

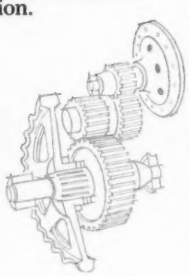
Allis-Chalmers presents the new

ANOTHER BIG STEP AHEAD IN LOW-COST DIRT MOVING

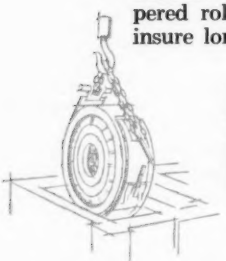
. . . with all the important performance advantages of Allis-Chalmers advanced basic design . . . tested and proved over millions of operating hours!



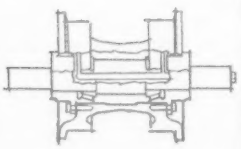
All-Steel Box-A Main Frame that soaks up shock loads, makes possible the service simplicity of unit construction.



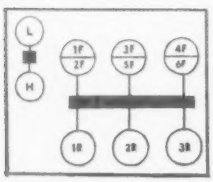
Exclusive One-Piece Steering Clutch and Final Drive Housing with all final drive gears straddle-mounted on tapered roller bearings to insure long life.



Unit Construction lets you remove engine, master clutch, transmission, steering clutches and final drives without disturbing adjacent parts.

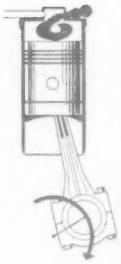


1,000-Hour Lubrication Intervals for roller bearing truck wheels, idlers and support rollers . . . makes production time out of service time.



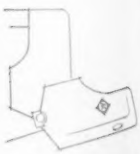
Dual-Range Constant-Mesh Transmission lets you go from any forward speed to any reverse speed by shifting only one lever. Eliminates double shifting! That means faster work cycles . . . more production!

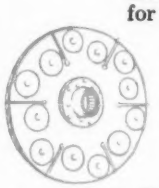
plus . . . these great new features:



New Allis-Chalmers Diesel Engine with "follow-through" combustion and tornado turbulence . . . for smooth engine performance, cleaner combustion, extra long engine life.

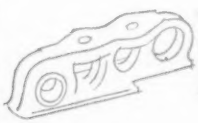
New Wrap-Around Radiator Guard used as dozer lift frame to simplify design, reduce cost of bulldozer; guard tilts forward for easy service.





New Master Clutch with Ceramic Lining sets new standards of clutch life . . . with fewer adjustments required.

New Operator Convenience including roomy, flat platform . . . foam rubber seat . . . 24-volt direct electric starting . . . 60-gal. fuel tank.

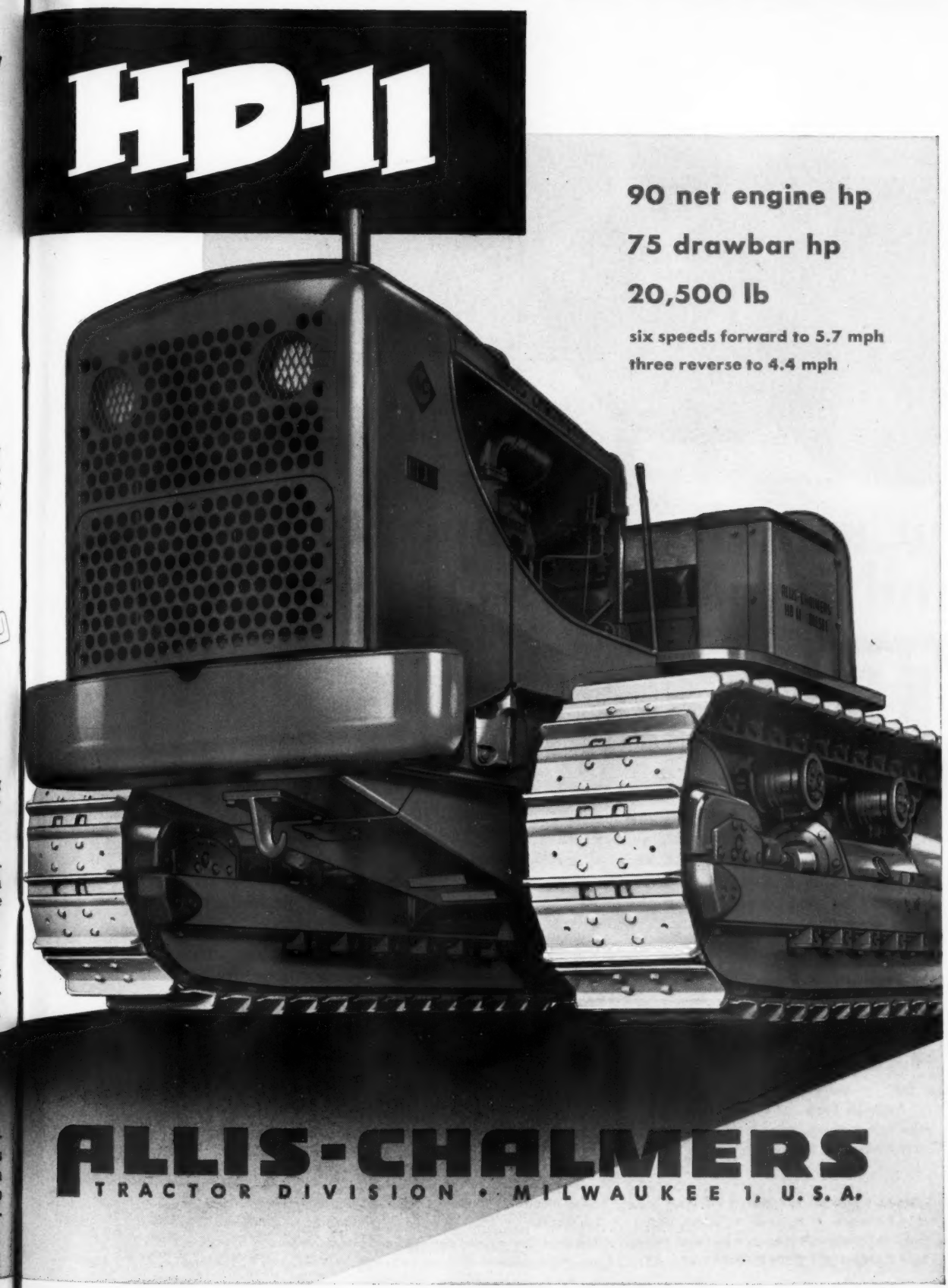


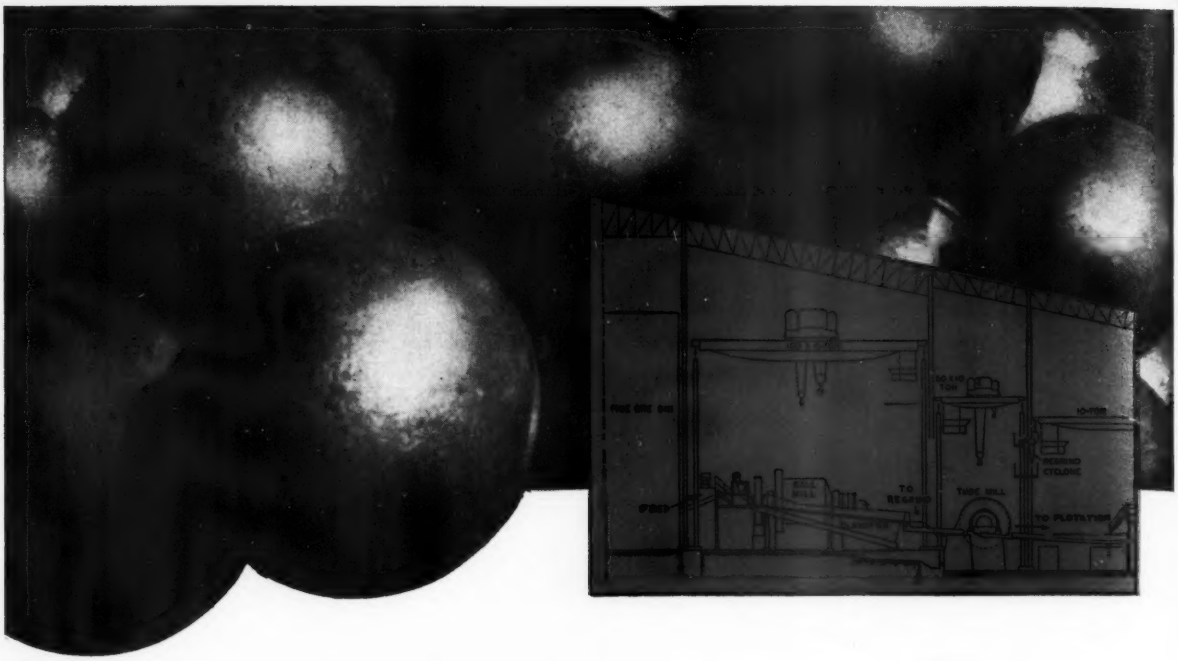
Tough New Track — New design, through-hardened with extra toughness for long life even in severe abrasive conditions.

PLUS . . . new, all-weather cooling; independent radiator-core mounting; new strength and capacity in final drive gears, shafts and bearings.

NEW STANDARDS OF PERFORMANCE AND LONG LIFE ON A WIDE RANGE OF JOBS

You owe it to yourself to investigate the performance advantages of the HD-11 . . . newest addition to the Allis-Chalmers leadership line. See your nearby Allis-Chalmers dealer now.


HD-11
90 net engine hp
75 drawbar hp
20,500 lb
six speeds forward to 5.7 mph
three reverse to 4.4 mph
ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.



for superior resistance to abrasion and impact in wet grinding...

CF&I GRINDING BALLS

You'll find that CF&I Grinding Balls are ideal for most types of wet grinding because they combine excellent resistance to both abrasion and impact. Because of this combination of properties, they can be used economically in wet grinding mills, operating at high or low speeds, with either high or low pulp concentrations.

CF&I Grinding Balls give this superior service because they are forged from special analysis steel. Since they are free of surface imperfections, CF&I Grinding Balls wear evenly. Further, each ball is carefully inspected throughout production and immediately before shipment to make certain that it has no surface pits, circumferential ridges or other surface unevenness.

CF&I Grinding Balls are available in diameters from ¾" to 5". For full details, get in touch with your nearest CF&I Sales Representative.

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Wickwire Rope
Mine Rails & Accessories
Cal-Wic Industrial Screens

CF&I FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION

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AUGUST, 1955

VOLUME 41 ● NUMBER 8

Mining

CONGRESS JOURNAL

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Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign $5.00. Single copies, $0.30. February Annual Review Issue, $1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

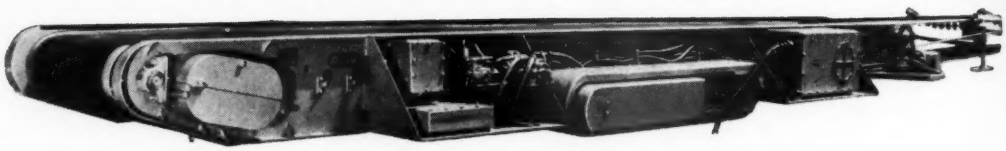
Indexed regularly by Engineering Index, Inc.

THE AMERICAN MINING CONGRESS
RING BLDG., WASHINGTON 6, D. C.

Here's the LOWEST COST, MOST MODERN WAY to carry your coal away from the face

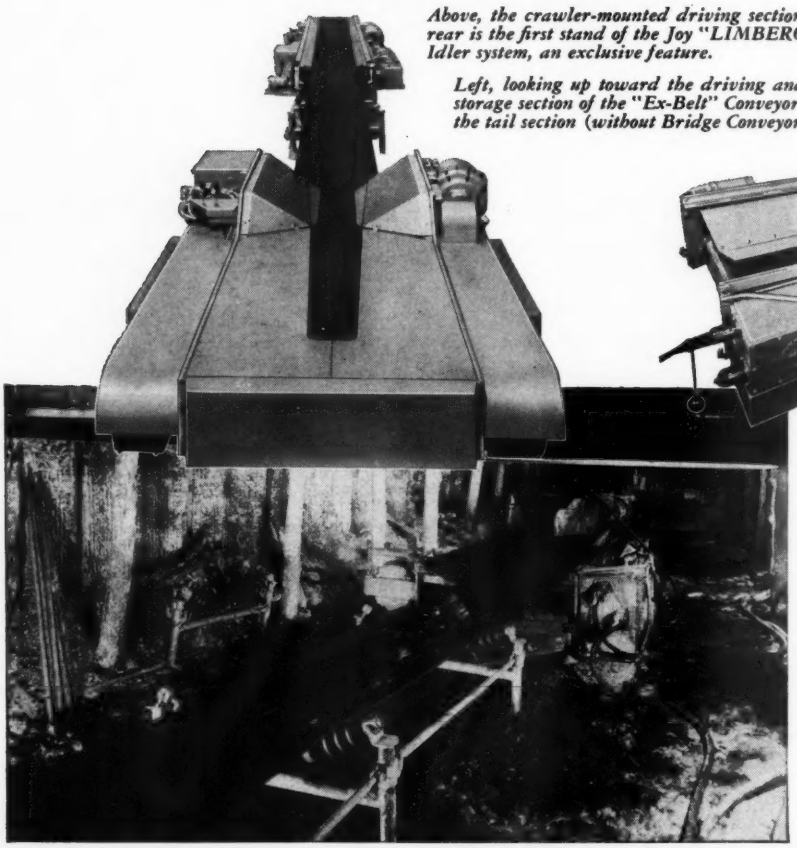
E-X-T-E-N-S-I-B-L-E

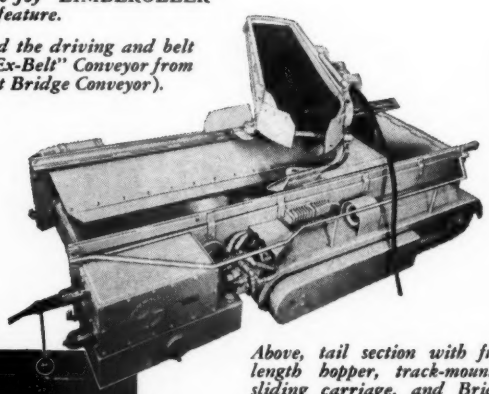
FOR TRUE CONTINUOUS HAULAGE



Above, the crawler-mounted driving section. At the rear is the first stand of the Joy "LIMBEROLLER" Idler system, an exclusive feature.

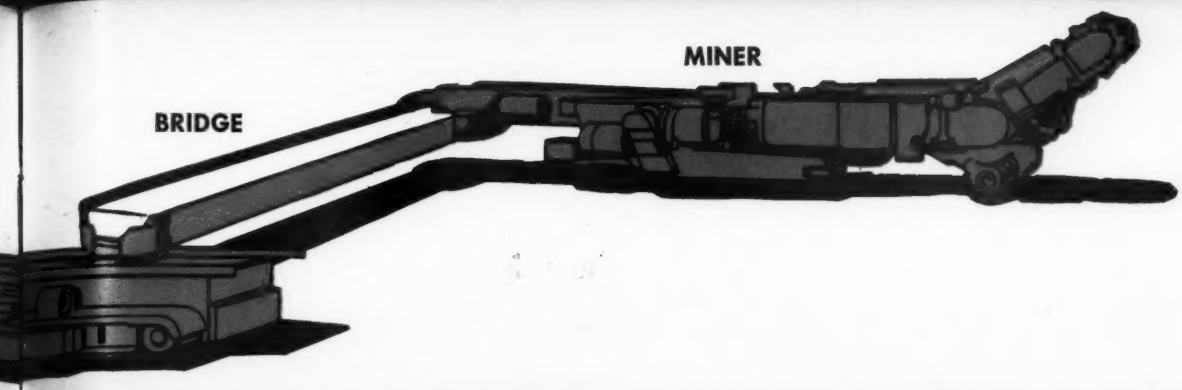
Left, looking up toward the driving and belt storage section of the "Ex-Belt" Conveyor from the tail section (without Bridge Conveyor).





Above, tail section with full-length hopper, track-mounted sliding carriage, and Bridge Conveyor which provides a flexible connecting link from a Continuous Miner (see drawing at top of page).

As the Continuous Miner advances while mining a room of 16-foot width, a continuous stream of coal moves away from the tail section and up the "Ex-Belt" Conveyor toward the camera. Note the perfect troughing of the belt and the smooth, steady action of the LIMBEROLLER idlers, rotating with practically no waver. Along the rib, note how the required idler stands and side rails for a 15' section of the belt stack compactly between timbers.



BELT CONVEYOR
FROM CONTINUOUS MINING MACHINES

EXTENDS OR RETRACTS 50 FT. AT A TIME UNDER FULL LOAD

With the Joy "Ex-Belt" Conveyor, once again we have broken into new ground in our continuing development of the science of mechanized mining. Once again a Joy field-proved unit gives you a real opportunity to make another important reduction in your production cost-per-ton . . . the saving you need to maintain or increase your profit margin today.

The Extensible Belt Conveyor now, *for the first time,* gives you a continuous haulage system for Continuous Miners in driving rooms and entries up as far as 1,000 feet, including breakthroughs and taking pillar on retreat. Available in 24", 30" or 36" widths, it consists of two main units: a driving section and a tail section, both of which are self-propelled on identical crawler treads. It extends or retracts 50 feet while operating under full load, and belt tension and slippage are under automatic control at all times. A 100-foot length of belt can be added or removed, as needed, in an average time of only 5.3 minutes; and the entire system can be moved over and set up for a new heading in less than 2 hours.

Perhaps most important of all, the Extensible Belt Conveyor follows the Joy tradition of simply-designed, rugged, foolproof equipment that can take the heaviest duty underground and stay on the job month in and month out. That is your final assurance of securing the favorable cost basis and production rates for which the Joy "Ex-Belt" was developed. ***Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ont.*

WRITE FOR BULLETIN J-303

TYPICAL FIELD PERFORMANCE

In an Eastern Ohio mine, operating in 54"-60" coal (Ohio #8 seam), a Joy Continuous Miner and Extensible Belt Conveyor team permitted the driving of rooms 16 ft. wide to a depth of 600 ft. Average production rate for panels of seven rooms varied from 302.3 to 325.4 tons per shift. Average time required to change over equipment was 1¾ hours (from shut-down in one room to start-up in the next).

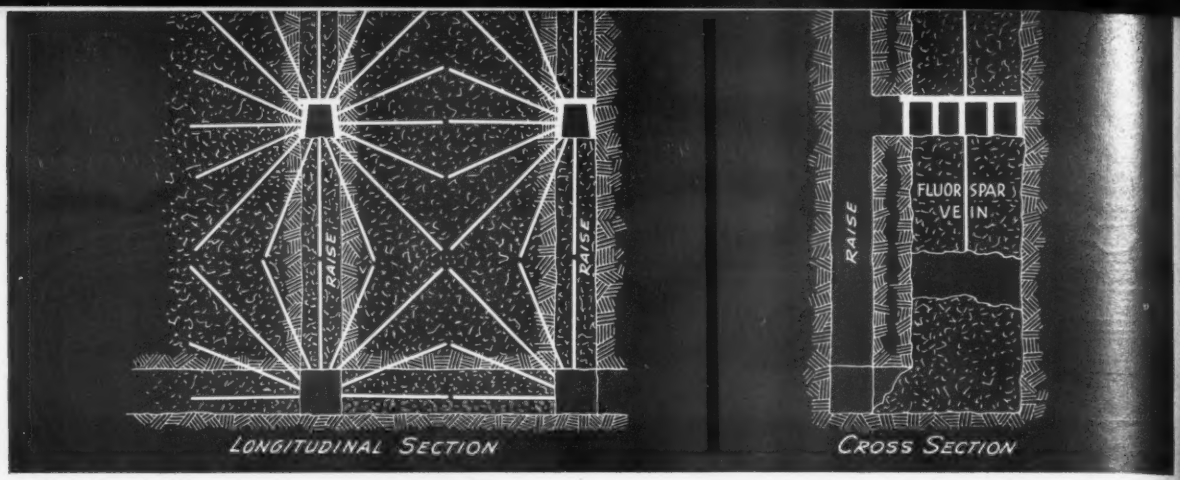
Consult a Joy Engineer

for a complete line of Belt Conveyor equipment available in all necessary belt widths, and various types of idlers and stands to meet any gathering or main haulage requirement.

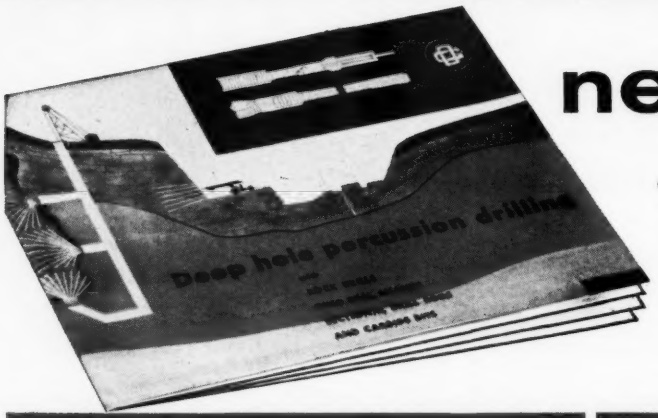
JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

W&D CL5362B



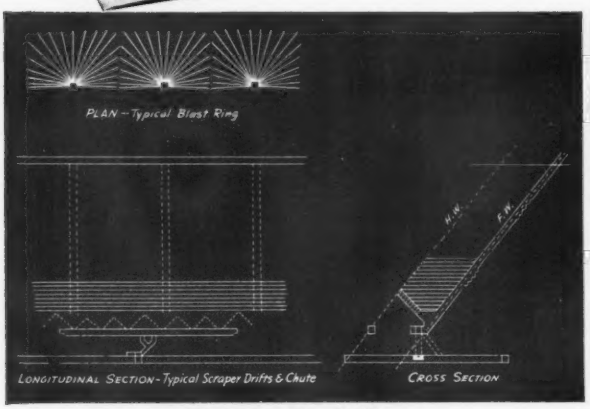
Vertical Ring Drilling



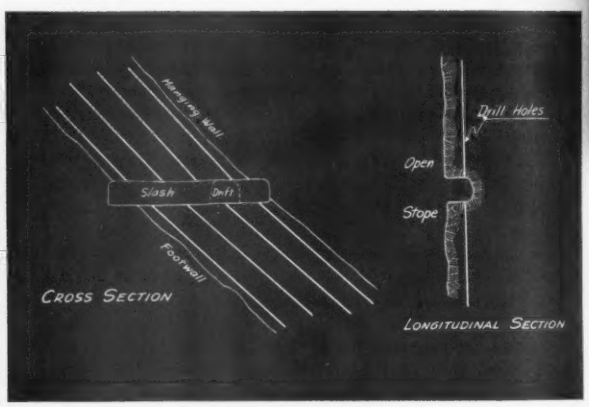
never before

. . . A BOOK LIKE THIS!

New deep hole drilling applications point the way to cost-saving underground mining methods with Gardner-Denver equipment engineered for deep hole percussion drilling.



Horizontal Ring Drilling



Boundary Pillar Recovery

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THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

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Call your shot... then call for American Electric Blasting Caps

...for American makes a cap for every type of blasting

That's right, you call your shot—instantaneous, regular or split-second delay—in coal mines, in quarries or on construction jobs. Then use American Electric Blasting Caps, for American makes the *right* cap to set your shot off dependably and economically.

And American Electric Blasting Caps also offer these positive advantages:

Choice of Delays—10 regular delay periods and 15 split-second delay periods meet virtually every timing requirement.

Timing Accuracy—the finest timing periods are produced for exact planned shooting.

Detonation Strength—more than enough to detonate most all insensitive dynamites.

Superior Insulation—five separate coats of Organosol insulation give unsurpassed electrical and strength properties.

And they're color coded for fast, sure identification.

The American Line:

High Explosives	Electric Blasting Caps
Permissibles	Instantaneous
Blasting Powder	Regular delay
Blasting Caps	Split-second delay

Blasting Accessories

If it's American, it's dependable.

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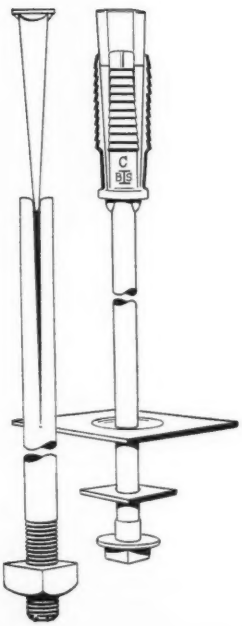
EXPLOSIVES DEPARTMENT

30 Rockefeller Plaza, New York 20, N. Y.

Sales Offices: Latrobe, Pa., Pottsville, Pa., Scranton, Pa., Maynard, Mass., St. Louis, Mo., Bluefield, W. Va.

In this installation, Bethlehem Roof Bolts are used with plate washers, steel roof ties, and wire mesh, to provide sound roof in a mine haulageway.

Roof Bolting Promotes Safety... Makes Mines More Productive



Your mine becomes a safer place for men to work when roof bolts are used for roof support. Not only that, production goes up, too, as there's hardly any time lost due to serious roof falls.

Bethlehem Roof Bolts promote safety and help to increase production because they do such an effective job of replacing old-fashioned, bulky supports. They bind layers of strata into self-supporting thick beams, and are particularly effective when used with steel roof ties.

Described here are four types of Bethlehem Roof Bolts, any one of which can contribute greatly to your safety program. For full details, write to us at Bethlehem, Pa.

SLOTTED BOLT This husky 1-in. bolt is ideal for troublesome roofs, as well as pillar bolting. The central slot is forged, without loss of metal. Opposite end of bolt has 5 in. of rolled threads. Steel wedge, started in slot when bolt is placed in 1¼ in. hole, is forced deep into slot when bolt is driven, spreading bolt-ends.

SQUARE-HEAD BOLTS (Three Types) Bethlehem makes three types of headed roof bolts for use with expansion shells: (1) a ¾-in. carbon-steel bolt, with typical breaking load of 24,000 lb, (2) a ⅞-in. high-strength bolt, also with typical breaking load of 24,000 lb, and (3) a ⅞-in. high-strength bolt, with a typical breaking load of 45,000 lb.

HARDENED WASHERS Bethlehem hardened washers, used with headed bolts, prevent galling or tearing of metal because they reduce friction occurring between the bolt head and roof plate when high tension in the bolt causes excessive bearing pressure. Bethlehem also produces a full line of mine roof plates, roof ties, expansion shells, and plate washers.

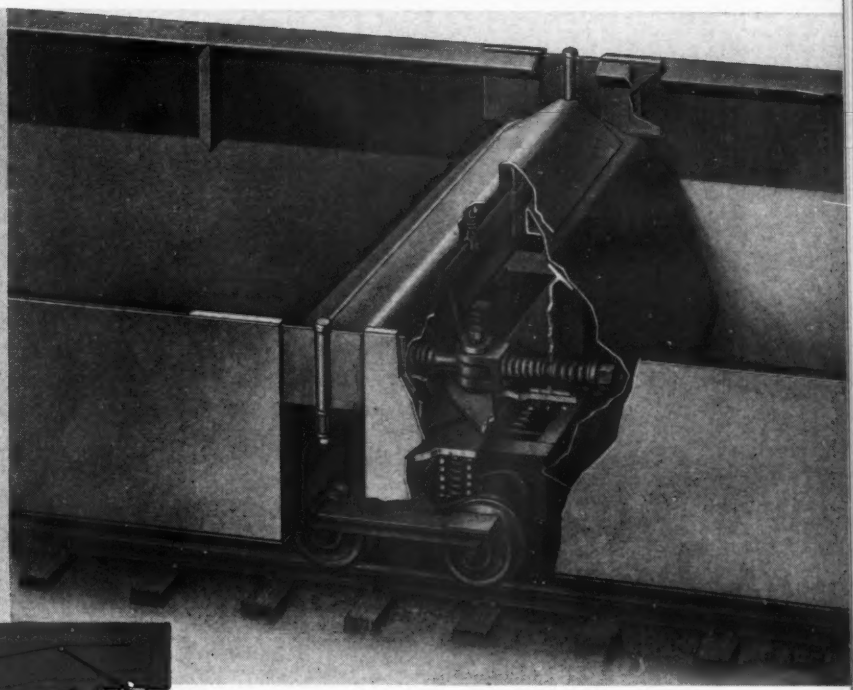
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

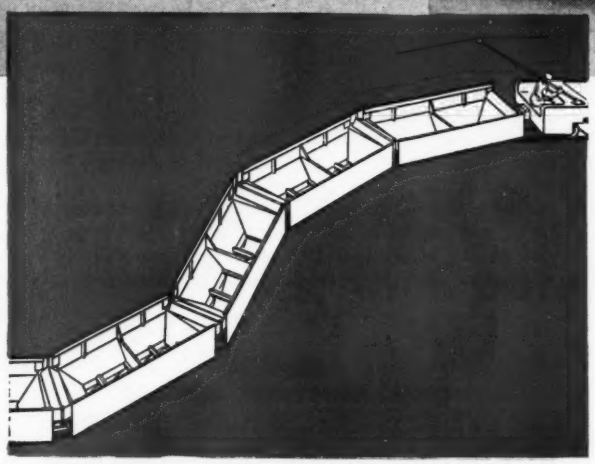
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

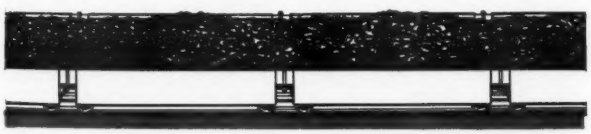
New! Revolutionary! acf Articu-Trip for Fast, Uninterrupted Haulage

- ✓ **Articulated Drop Bottom Cars permit continuous, non-stop loading and unloading**
- ✓ **Drastically reduce spillage**
- ✓ **Eliminate wide "turnouts"**
- ✓ **More tonnage in shorter trains**
- ✓ **"Shutdown-Proof" operation**





Articulated design permits continuous loading without stopping and avoids spillage between cars.

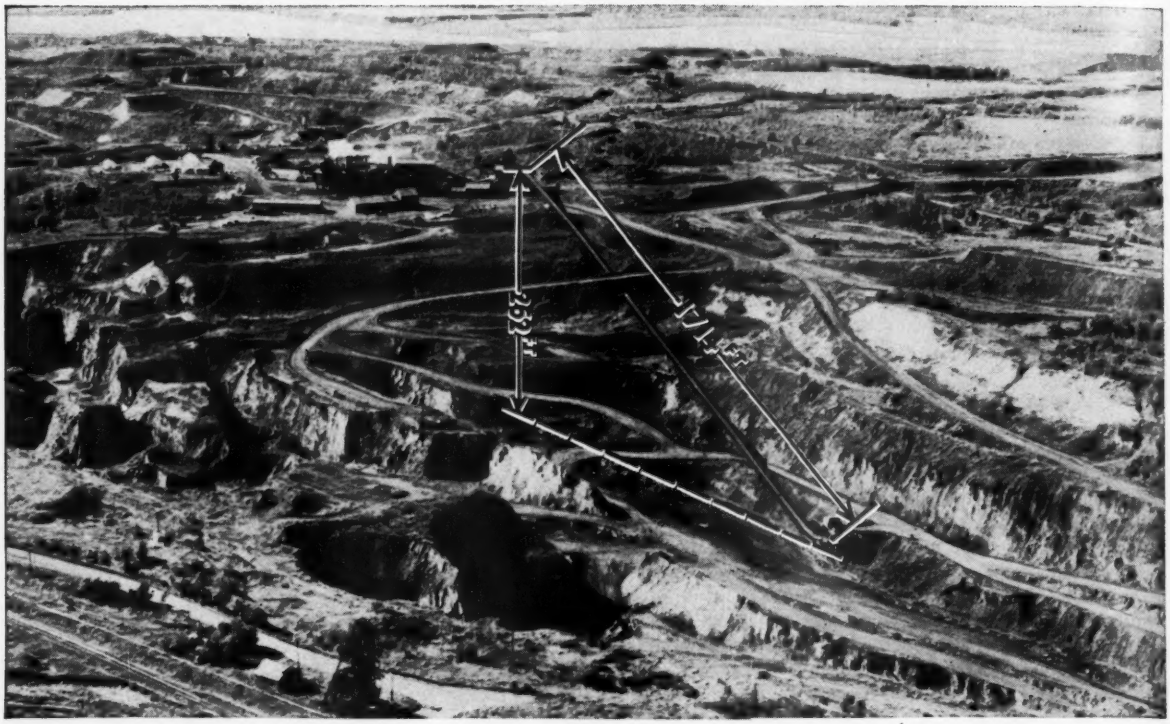


The revolutionary articulated design of acf "Constant" Mine Trains permits highspeed uninterrupted coal handling from face to dumping point! Without stopping, and without spillage...it can be *continuously* loaded...hauled at unusual speeds...and unloaded! No space between cars...shorter trains have increased capacity! Far less overhang on curves...no wide "turnouts" and extra timbering needed. Most important, here's a continuous haulage system that won't be shut down for repairs. Ask your acf Representative for complete data now!

acf Industries, Incorporated, New York · Chicago St. Louis · Cleveland · Philadelphia · Washington · San Francisco · Berwick, Pa. · Huntington, W. Va.

acf MINE CARS *for Constant Haulage*

Planning an ore handling project?



Straight as an arrow, Link-Belt roller bearing belt conveyor rises from iron ore pit floor to concentrating plant. Almost one-third of a mile long, its uninterrupted delivery of high tonnages permits far lower handling costs than other forms of transportation.

LINK-BELT accepts complete responsibility for design, equipment, erection and performance

As mineral deposits grow leaner, larger and larger tonnages must be handled to recover concentrates in quantities to meet ever-increasing demands. At the same time, the processing of many ores has become more complex. These are two good reasons why it pays to call in Link-Belt if you're planning an ore handling project.

For Link-Belt will accept complete responsibility for the design, erection and furnishing of systems for handling ore and overburden—plus responsibility for satisfactory performance.

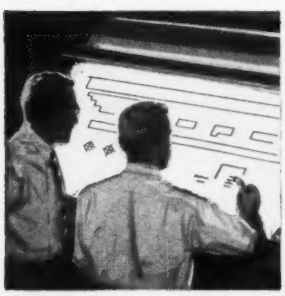
An installation—typical of many on which Link-Belt has performed this overall function—might move huge tonnages from the mine . . . process, store and reclaim the material . . . finally carry it to rail or dockside and load it out.

Get the facts on how this single *proved* source can integrate every factor of any contemplated project, large or small. A call to the Link-Belt office near you will place Link-Belt's broad engineering facilities at your disposal.

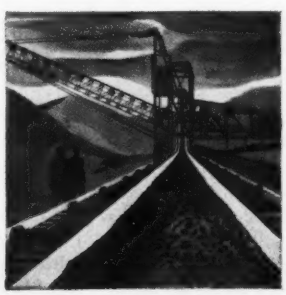
LINK-BELT

PROCESSING AND HANDLING EQUIPMENT 13,398

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

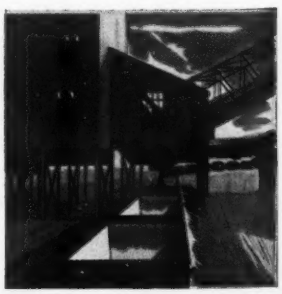


OVERALL ENGINEERING. Experienced design and field engineering staffs integrate all factors, assure expert planning.



DEPENDABLE EQUIPMENT. From Link-Belt's broad line, you get equipment that will stand up under the toughest jobs.

COMPLETE ERECTION. Experienced Link-Belt superintendents, staffs and skilled crews carry through on every detail.



SATISFACTORY PERFORMANCE. When you rely on Link-Belt as a source, we accept responsibility for successful operation.

MARION 2½ cu. yd. Shovel Strips Rock in Open-Pit Barite Mine

This MARION 93-M has a steady diet of rock in an Arkansas barite mine. Working in benches, it will eventually go to a depth of several hundred feet to follow the irregular shape of the barite vein.

The MARION works entirely in rock ranging from soft shale to hard sandstone.

Get the full story of what the 93-M can do to meet your heavy-duty, continuous-service excavating requirements. Write for Bulletin 397 (Diesel) or Bulletin 401 (Ward Leonard Electric).

MARION / **MARION POWER SHOVEL COMPANY**
MARION, OHIO, U. S. A.

A Subsidiary of Merritt-Chapman & Scott Corporation

POWER SHOVELS FROM ½ TO 60 CUBIC YARDS
PILE DRIVERS • WALKING DRAGLINES

DRAGLINES • CLAMSHELLS • LOG LOADERS
CRANES, CRAWLER & RUBBER MOUNTED • BACKHOES

Your Confidence Is Justified Where This Flag Flies

Bucyrus-Erie 950-B stripper removes overburden from Traux-Traer Coal Company seam in Fulton County, Illinois. Operation is one of the largest open pit mines in Fulton County, Illinois' second biggest coal producing county. CALUMET Viscous provides lubricant shield for roller swing gear.

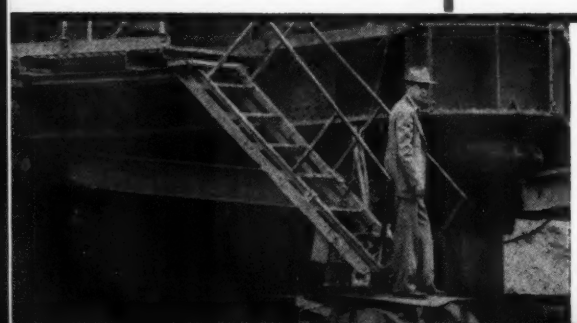
Stripper rides on CALUMET *Viscous Lubricant*

CALUMET Viscous Lubricant has been assigned the job of protecting circle rail rollers and swing gears on a 950-B Bucyrus-Erie stripper at Traux-Traer Coal Company's mine in Fulton County, Illinois. It's been doing this job—and doing it well—for many years. It has had to, for delivering top performance is expected of both lubricants and equipment at this mine. The production goal is a stiff 1,000 tons of coal an hour.

The stripper operates continuously in all kinds of weather—hot, cold, wet, dry, dusty. Selection of CALUMET Viscous Lubricant for this job was a logical decision. CALUMET Viscous is designed to perform under just such conditions. Its adhesive qualities make it stick to gear surfaces and form a near perfect gear shield. It doesn't sling off during warm weather or chip off in cold weather. It can be applied easily and evenly when sprayed or swabbed, does not require preheating.

CALUMET Viscous is one of a large number of lubricating greases in the Standard line. In the Midwest, a lubrication specialist from your nearby Standard Oil office will be happy to tell you about them. Call him today, or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Bob Wright, Standard's lubrication specialist, mounts steps to inspect roller swing gear lubricated with CALUMET Viscous. On-the-spot technical help such as this is one of the services Bob performs for his customers. Bob's training includes a B.S. in engineering from Michigan College of Mining, and Bob has completed the Standard Sales Engineering School. Customers find such training pays off for them.



STANDARD

STANDARD OIL COMPANY (Indiana)

Premium Pocahontas Coal prepared with R&S Airflow Equipment

The modern preparation plant of the American Coal Co. of Allegany County is now producing premium stoker size coal from its Pocahontas No. 3 seam at the Deerfield mine in Wyoming County, West Virginia.

This new plant, engineered and designed by Roberts and Schaefer, employs two units of R & S Airflow equipment for cleaning 3/8" x 1/8" stoker coal and is delivering the exact results required by the owners.

In every R & S Airflow installation—and there are hundreds of units in service both in this country and abroad—Airflow equipment has proved its economy and value. It makes a good coal a better coal and poorer grades more acceptable and saleable.

Do you know what Airflow Equipment can do for you?

It will fit readily into your new preparation plans or into your present operation and will provide:

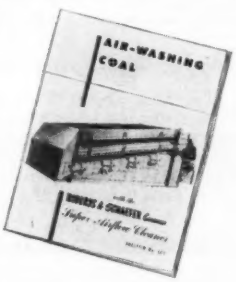
Consistent, efficient cleaning of a wide range of sizes—up to 1 5/8" and larger; down to 48 mesh.

Low-cost, trouble-free operation and far less maintenance even when capacities are big and sizing is not precise.

Separation of dust for recombining with clean coal when desired.

And note, too:

Air-washed coal flows freely, will not freeze, sheds rain in transit, is more amenable to oil treatment.



• *Phone, wire or write today for Bulletin No. 175 giving complete information including typical layouts for various types and sizes of coal; or contact our nearest office for consultation without obligating yourself in any way.*

ROBERTS and SCHAEFER COMPANY

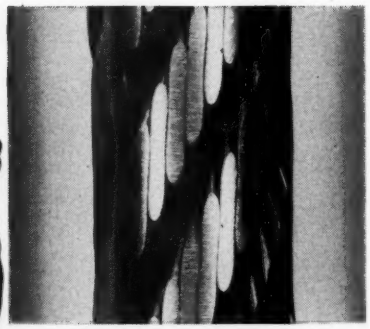
Subsidiary of Thompson-Starrett Company, Inc.

ENGINEERS AND CONTRACTORS

130 North Wells Street, Chicago 6, Illinois

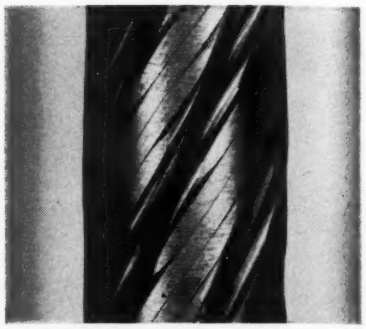
New York 19, N. Y.—254 West 54th Street
Pittsburgh 22, Pa.—1315 Oliver Building
Huntington 9, W. Va.—P. O. Box 570
Hibbing, Minn.—P. O. Box 675

Tuffy® tips on the "lays" and



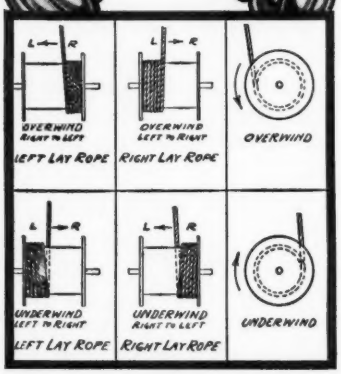
Partially Worn Regular Lay

Regular Lay ropes are used to a greater extent than Lang Lay, because Regular Lay wire ropes stand up better under the hazards of installation and use. Regular lay ropes are less susceptible to drum crushing and are not so readily damaged on sheaves of small tread diameter.



Partially Worn Lang Lay

Lang Lay ropes are about 15% more flexible than Regular Lay, and have a wearing surface *per wire* about three times as great. However, they crush out of shape more easily on small drums and are more easily damaged by sheaves with small tread diameter.



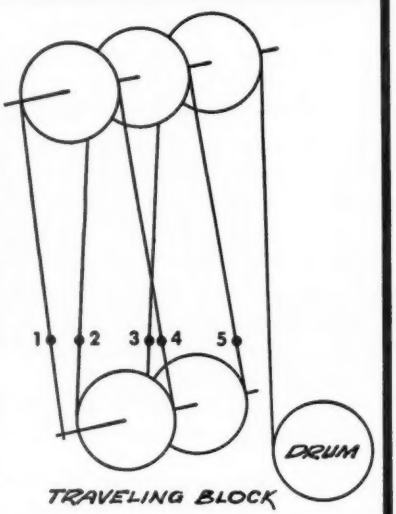
Rope Lay for One Layer Winding

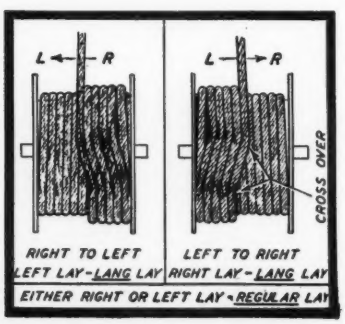
These diagrams show when it is best to use right lay or left lay rope on one-layer winding. The direction of winding is determined by standing behind the drum, looking toward the direction of the rope travel.

How To Count The Number of Parts Supporting the Load

The wire rope on many machines is not used in a single part or direct pull. It is often reeved through sheaves, which multiplies the power applied to the load. Drawing an imaginary line across the reeved rope parts, above or below the "crossing", and counting across gives you the number of parts supporting the load. Always include the rope end to the block, but not the part leading to the drum.

Send For Free Chart Which Allows Easy Figuring of Actual Stress On Rope For Any Given Piece of Machinery Reeving From One to Eight Parts.



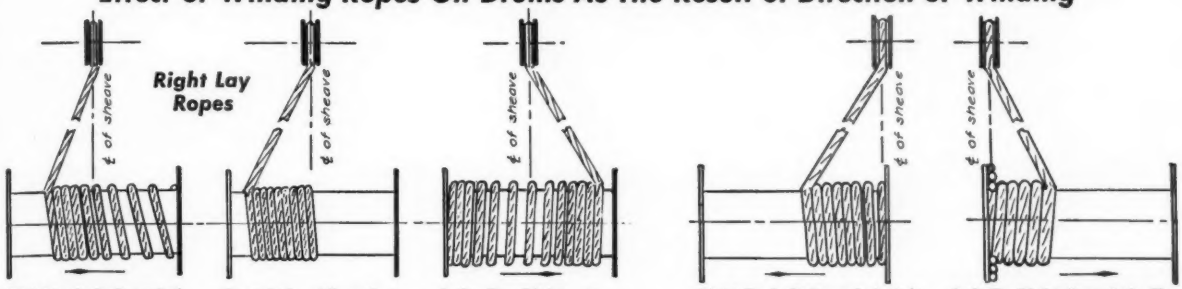


Rope for Two Or More Layer Winding

When a rope winds on the first layer across the face of a drum, it usually travels in a uniform pattern. But when it reaches the flange of the drum, the rope rides on the last strand of the first layer for one turn. Then, it slips into the grooves between each course of rope on the first layer. To move across the drum in this manner, the rope actually winds *back* a turn in each revolution. Then it must jump across *two* grooves in the first layer. This always occurs on the even-numbered layers, and often causes crushing. This abuse is minimized by use of properly designed grooves, spacers and lifters.

reeving of Wire Rope

Effect of Winding Ropes On Drums As The Result of Direction of Winding



Right to Left Overwind. Rope winds open to centerline of the drum, then it winds close.

Overwind. Allowed to run freely, the rope winds close to the left from center of drum.

Left To Right. Rope winds close the first four turns, open to center of drum, then close.

Right To Left Overwind. First two turns about 3/16" open, the balance close. Does not build up on flange.

Left To Right Overwind. The rope will build up three to four turns on flange before crumbling, then wind close.

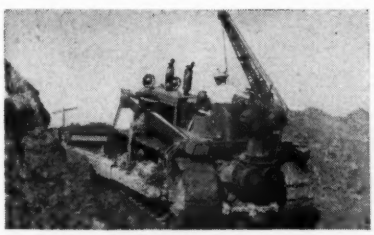
Yours For The Asking—The "Know How" of Specialists

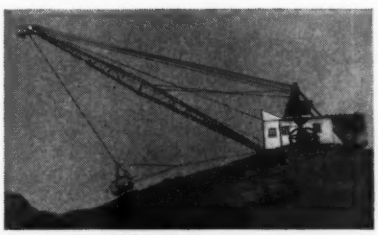
Put your problems up to Union Wire Rope technicians who work closely and continuously with users and machine manufacturers to lengthen the service life of wire rope through both design and application.

Out of this exhaustive research has come the industry's greatest advancement—the Tuffy family of special purpose ropes that offer you the construction, operating characteristics and grade of steel that are best for the particular job for which each is constructed.

So thoroughly have the ropes of the Tuffy family been engineered that the chances of ordering the wrong rope is virtually eliminated. When you order Tuffy wire rope, you...

Stop Specification Complications—Say Tuffy





Tuffy Dozer Ropes

Constructed to increase rope life. 1/2" and 9/16" sizes on reels. Less frequent slip-through for cut off. No waste of sound rope.

Tuffy Dragline

Two big working advantages: (1) Outer wires have large area to resist abrasion. (2) Inner structure is flexible for accurate casting.

Tuffy Scraper Rope

Tailored to cope with the complex destructive forces imposed in the rush of making more round trips or in tough going.

Tuffy Slings

Constructed to stay extra flexible; kinking or knotting won't materially damage. Unique and strong 9-part machine-braided wire fabric construction. With Tuffy Hoist Lines, Tuffy Slings give you a team of balanced performers.

Tuffy Slusher Rope

A special 3-strand construction which combats rope killing conditions of slusher loading such as drum crushing, extreme abrasive wear and shock loading. Easily spliced.

Your Tuffy Distributor: Dependable Source of Information.

His job is more than just supplying the wire rope you want—when you want it. Your Tuffy distributor is always on the alert to help make your equipment do the best possible job, at the lowest possible cost. When you have a problem that calls for special knowledge concerning your equipment that uses wire rope, give your Tuffy distributor a call. He'll be glad to furnish the help you need including factory engineers.

union Wire Rope **corp.**

2144 Manchester Avenue, Kansas City 26, Missouri

Specialists in High Carbon Wire, Wire Rope and Braided Wire Fabric

●3-M

Announcing the Zephyrcranes

A NEW complete line of advanced-design Truck-Cranes

The new Link-Belt Speeder line of truck-mounted Zephyrcranes features Speed-o-Matic — the true power-hydraulic control system. Fingertip-operated, it provides fast, easy, positive response, perfect "feel" for speed with accuracy. And because it greatly reduces operator fatigue, keeps him alert . . . you increase safety, and your operator is able to maintain greater output with less effort.

Check these features

- **REVERSING CLUTCHES** are available for either or both main drums . . . provide power load lowering of main hoist line and jib whip line.
- **THIRD DRUM** available for HC-88, 98, 108 is particularly valuable for piledriving applications.
- **ALL CLUTCHES ARE INTERCHANGEABLE** (within each model) with exception of front drum reversing clutch on the HC-58 and HC-68.
- **HIGH-SPEED, INDEPENDENT BOOMHOIST** with power raising and power controlled lowering through Speed-o-Matic boomhoist and lowering clutches is standard on HC-88, HC-98 and HC-108. Available for the HC-58 and HC-68.
- **PATENTED RETRACTABLE HIGH GANTRY** is quickly raised or lowered under power. In raised position, it reduces stresses on boom and boomhoist cable. Standard except on HC-58 and HC-68.
- **FULLY CONVERTIBLE** to standard attachments.
- **REMOVABLE REAR OUTRIGGER ASSEMBLY** permits easy, quick changeover for shovel, hoe or dragline operation.
- **COUNTERWEIGHT REMOVAL DEVICE** using Speed-o-Matic hydraulic jacks, speeds removal and installation of counterweight. Available on HC-88, HC-98 and HC-108 models only.
- **HYDRAULICALLY CONTROLLED SWING BRAKE** is standard on HC-88, HC-98 and HC-108.
- **SCREW-TYPE OUTRIGGER JACKS AND PONTOONS** available.
- **TORQUE CONVERTER** power units available.

For details, contact your distributor or write
LINK-BELT SPEEDER CORPORATION, Cedar Rapids, Iowa

HC-98 Zephyrcrane with 80′ boom and 20′ jib works quickly, spots loads gently, accurately. Operator has clear, up-front visibility.

LINK-BELT SPEEDER

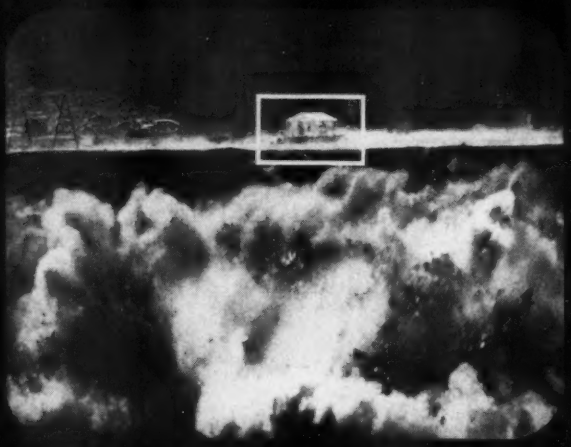
Builders of a complete line of crawler and rubber-tired shovel-cranes

13.869

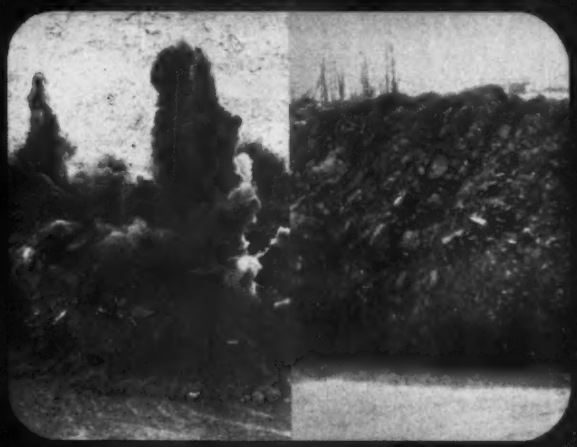
Five models 12½ to 35-ton capacities with true power-hydraulic control

HC-58	HC-68	HC-88	HC-98	HC-108
12½-ton	17½-ton Remote control available.	25-ton	30-ton	35-ton

COST-CUTTING MEMOS:



AVOID POOR PUBLIC RELATIONS EXPENSE: When you're blasting near buildings, the ATLAS Rockmaster® System puts all the explosives energy to work on the burden . . . controls vibration, noise, flying rock and throw. Power is confined for greater efficiency. Permits bigger, money-saving blasts . . . reduces costly complaints.



COMPARE METHODS: Traditional blasting procedures, however satisfactory they seem, may actually waste explosives power in flying rock and spouting gas. Modern Rockmaster methods, pioneered by ATLAS, improve fragmentation and control throw . . . reduce backbreak, noise, and vibration . . . step-up efficiency and profits.

USE THE RIGHT CURRENT SOURCE: A blasting machine with inadequate output is the most expensive. The new ATLAS "Shotmaster" Condenser-Discharge Blasting Machine supplies plenty of power for complex circuits. Eliminates dependence on power lines. Provides every safety advantage, with simplified operation. Ask your ATLAS Representative about it.

KEEP UP WITH THE LATEST BLASTING TECHNIQUES: Rockmaster now offers Alternate Velocity Loading for improved breakage, greater efficiency. Rockmaster methods, so advantageous in stripping, are finding increased use underground. Get details from your ATLAS Representative. And send for "Better Blasting," Atlas quarterly bulletin on latest methods.

IMPROVED, modern blasting methods boost production, ease handling, and net higher profits. Why not review your present blasting methods with your ATLAS Representative. He can probably suggest many cost-cutting ideas tailored to your specific needs. Atlas' periodical bulletin on latest methods and equipment is yours for the asking. Let us put your name on the mailing list for "Better Blasting," today.

ATLAS

ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

Offices in Principal Cities

get-up-and-go POWER

... look here and see why!

Within the frame of this streamlined locomotive are two 190 HP motors . . . a pair of giant muscles to power Jeffrey's 27-ton four-wheel model.

These exceptionally large-capacity motors, each with ventilating blower, are ideal for the toughest and longest hauls because of high thermal capacity.

The largest four-wheel locomotive in coal mine use today, this unit has a rated drawbar pull of 13,500 pounds at speed of 10.8 MPH. Haulage on level track with clean, dry rail is 675 gross tons, without use of sand.

A long wheelbase, transverse equalizers, hydraulic snubber, and overall balanced design give an easy Pullman ride that motormen appreciate. It hugs the rails even on bad track.

Get mine locomotive catalog 836 by writing Mining Sales Division, Jeffrey Manufacturing Co., Columbus 16, Ohio.

OTHER FEATURES:

- Ten-step, straight parallel acceleration with full electro-pneumatic contactor control.
- Nine-step dynamic braking. Controller handle is turned clockwise from "off" for motoring and counter clockwise for dynamic braking.
- Straight air brakes, air sanders, air horn.
- Roller bearing journals and motor axle suspension.
- 32-volt battery operated control and headlights . . . both are effective even if power fails or trolley leaves wire.
- Automatic couplers.

DIMENSIONS:

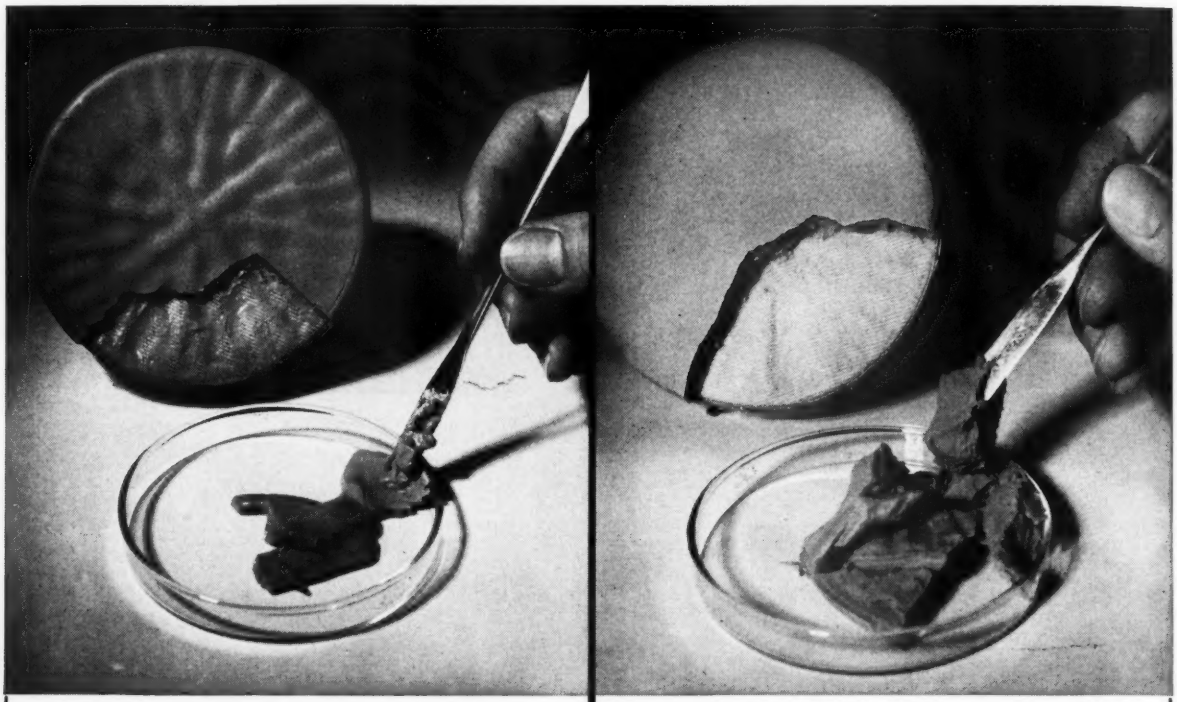
Minimum track gauge	42"
Wheelbase	100"
Height (exclusive of trolley)	42"
Height (trolley locked down)	49"
Width (for 42-48" gauge track)	84"
Length (exclusive of couplers)	23'4"
Wheel diameter	36"

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Separan 2610

GREATLY IMPROVES FILTRATION



Above picture shows thin cake formed on filter with untreated solids. Cycle includes 15-second cake formation and 45-second drying time.

During the same cycle, a much thicker cake is formed by treating with 0.15 lb. of SEPARAN 2610 per ton of dry solids present.

New flocculating agent speeds up filtration and settling rates, brings many other improvements to liquid-solid separations

THE DOW CHEMICAL COMPANY
Dept. TS 789E-1, Midland, Mich.

Please send me information and a trial sample of SEPARAN 2610.

Name_____

Company_____

Address_____

City_____ State_____

Prove to yourself the advantages of Separan* 2610 in filtration.

1. Increased cake size
2. Decreased cake moisture and better washability
3. Easy to handle and less dusty cake
4. Less material loss in filtrate
5. Effective over wide pH range

Prove to yourself the advantages of Separan 2610 in settling.

1. Up to 40 times faster settling rate
2. Increased overhead clarity
3. Less materials loss in overhead
4. Reduced cost in acid and alkaline media
5. Increased plant capacity

SEPARAN 2610 is highly effective in these industries:

- Uranium
- Clay
- Borax
- Cement
- Alum
- Potash
- Foundry Sand
- Coal
- Phosphoric Acid
- Iron Ore and Taconite
- Industrial Water, and Waste
- Miscellaneous Metals

*Trademark of The Dow Chemical Company

you can depend on DOW CHEMICALS

DOW

1105...YES, ELEVEN-O-FIVE

is the new-strength wire in Roebling's

Royal Blue

WIRE 1105 ROPE

AS SIZES and constructions go, Royal Blue is like the ropes you have used until now... but the likeness ends there.

Royal Blue is made of Roebling's new 1105 wire, the strongest, toughest wire developed up to now for use in any wire rope.

Royal Blue Wire Rope is as enduring as the wire from which it is made.

Write us for full facts on Royal Blue Wire Rope, or contact your Roebling distributor.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 5216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

A9A HAND-HELD HYDRAULIC DRILL

Here is a light, fast, efficient drill which is proving its worth daily in many mines.

It weighs only 25 lbs. without hoses. The A9A is housed in a strong, light aluminum casting for long-life service. Hoses are light and easy to handle. Hose connections (just two) are on rear of drill housing on centerline with handles, giving good balance for easy operation.

The A9A is fast. As many as fourteen 1 5/8" diameter holes, 9 feet deep, have been drilled in a five minute period. Amount of pressure applied to conveniently located operating lever along side of one handle regulates variable auger speed. Valve design returns A9A to free flow instantly when handle is released, stopping drill.

The A9A has an axial piston type hydraulic motor, chosen because of its superior efficiency. Drill can be adapted to most cutters, loaders, roof drills etc. having a suitable hydraulic system by adding hydraulic power take-off. The A9A will operate satisfactorily with pressures of 900 to 2000 PSI with 12 to 20 gallons of oil per minute, and with a minimum oil tank capacity of 20 gallons.

Write to Mining Sales Division, The Jeffrey Manufacturing Company, Columbus 16, Ohio for Leaflet 893.

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

★ Mining ★
CONGRESS JOURNAL
Published for the Entire Mining Industry
by the AMERICAN MINING CONGRESS
JOHN C. FOX, Editor
Volume 41 AUGUST, 1955 Number 8

The Mills Grind Fine

AS was to be expected with 1955's higher level of industrial activity, the coal mines of the nation are turning out more tons of coal than they did last year. Cumulative production to the end of July was nearly 43,500,000 tons greater than in the same period of 1954.

But coal prices are still far out of line with those of other industrial products. Average mine realization in 1948 was $4.99 and in 1954 it was only $4.82. In the fore part of 1955 it was, if anything, still lower. When a coal man talks of "realization," he means the total dollars received divided by the total tons produced.

Operators in one heavy producing section of the country lost 15 cents on each ton of coal they mined last April, despite the fact that production was up 22 percent from 1954.

Coal is caught in the squeeze between an unnaturally low selling price and inflated costs for labor and supplies plus heavy expenditures for capital equipment and high freight rates that adversely affect its competitive position.

Several factors are responsible for forcing down the sales price of coal. First is the practice of selling natural gas at less than cost—and for inferior uses. Second, the dumping of foreign residual fuel oil, the waste product of overseas oil refineries, on our eastern seaboard. Third and perhaps the unkindest cut of all, are the coal purchasing practices of our Government-owned electric power plants. When they buy coal at distress prices, they set the level at which privately owned utilities must buy if they are to compete.

The industry has done a remarkable job in lowering production costs through mechanization and increased efficiency. It has absorbed the series of pay hikes and welfare fund royalty increases that place coal miners among the highest paid industrial workers. It has absorbed each turn of the inflationary spiral that affects all materials and supplies. It has absorbed all these and still lowered production costs and increased output per man employed.

Are such prodigies of efficient production to be penalized?

The Federal Government has recognized the importance of the Coal Industry to the national wellbeing and security. The Cabinet Committee on Energy Supplies and Resources has made certain recommendations that would alleviate conditions under which coal mining is laboring.

The Office of Minerals Mobilization has been established to see that the basic minerals and the productive capacity needed for our mobilization base are made available. Here is coal being ground into dust between the millstones, and helpless to do more for itself. Let OMM get to work on this problem before it is too late.

C'mon In

EVER since its organization in 1910, the U. S. Bureau of Mines has assisted and encouraged the holding of First Aid and Mine Rescue contests. Such contests stimulate interest in mine safety work and encourage the training of qualified men who can be called on when needed.

Over the years the Bureau has helped conduct 16 national and international contests with teams coming to compete from as many as 20 states, Canada and Mexico, and from all branches of the industry. No contests were held between 1930 and 1950. In the 1950 contest only 16 first aid teams from four states competed. In 1951 there were 55 first aid teams and 14 mine rescue teams from 10 states. In 1953 there were 47 first aid and again 14 mine rescue teams from nine states. Since revival of the contests the competing teams, without exception, have come from the coal mines of the country. The 1955 Contest will be held in Knoxville, Tenn., October 10 to 12 and this year for the first time metal miners are entering. American Zinc Co. of Tennessee will have both first aid and mine rescue teams in the contest. The Tennessee Copper Co. has entered two first aid teams and a mine rescue team.

This is good. It is hoped that even more teams from the metal mining and industrial minerals field will compete for the Congressional Plaque and the hundreds of other prizes.

Don't let this be solely a coal contest—metal miners and industrial mineral producers should get in the swim too.

Scientific Mining Increases Profits

Tillie the Toiler sports a new control cab

Application of Theory Aided by the Intuition Born of Experience Increases Economy and Productivity

By THOMAS M. WARE
Vice-President, Engineering Division
International Minerals & Chemical Corp.

FOR the past decade, management has had its nose right on the grindstone with clear-cut objectives. This started with the World War II years, when staggering production goals and increased productivity were the important aims, when our nation's life was in jeopardy. Since the war period, management has been carrying out a host of "deferred projects," most of which had been held up by the war, when companies had little freedom to rebuild, modernize, expand, or diversify their business facilities.

To engineers in mining, the programs of the past decade have been challenging, to put it mildly. On the other hand, these programs have been so specific and all-consuming, engineers have had little opportunity to stand off and analyze the whole. In fact, the engineer in the mining industry has become so channeled by direct assignment over a long period of time that he may fall heir to the same criticism so frequently leveled at him in years prior to the last war. Management was prodding him for a searching, perspective analysis of its operations, and for near miracle equipment design innovations, to get yet more cost reduction to meet competition.

A Pause That Refreshes

This decade of almost completely channeled assignment is about at an end. The need for original contribution is back in the engineer's lap as a prime area of opportunity. To get back that knack for a newer approach, to turn out really important cost savings ideas, we need to stand back once more and look at the whole—and not only at mining, but at its related areas of activity as well. If engineers are to be of maximum usefulness to their industry, they need to ask a lot of deep and searching questions about the whole, the relationship of its parts. Call it a pause that refreshes, or more explicitly, a period of thinking with thought-provoking methods of analysis. To dare to think differently, and to shun time worn grooves—is bound to provide a refreshing, rewarding experience.

It is always a pleasure to visit an old-time miner's offices because, not only does it have a friendly feel, but invariably it has some pictures depicting yesterday's methods. These pictures make us more aware of the really important gains in mining methods and equipment changes. They focus attention on the principal gains which are the "building blocks" today's engineers must use as a starter. In short, these pictures not only warm the soul with appreciation of today's improvements, but they always invite one to take a crack at further advances in engineering, a true challenge.

It's not easy to enumerate the principal gains made in mining and arrange them so that they will generate any new ideas. Development of wholly new equipment to meet the challenge of higher labor costs; development of bigger and bigger equipment with higher and higher capacities; the trend to greater mobility and flexibility; the great abundance of low cost electric power; the value of highly specialized technology as

developed by other industries that can serve the mining industry; the increasing demand for mine products; and the up-grading of labor and its living standards. These are just a few principal pillars for modern thinking in the mining field. All are rightfully classed as big gains—but for yesterday only. These are what we start with today!

At International Minerals & Chemical Corp., we have directed most of our efforts, in searching for new improvements in mining technology, towards the Phosphate Minerals Division, which operates three large open pit strip mines in Florida. Already acknowledged to be the lowest cost mining methods known these mines utilize large draglines which dig over 28,000,000 cu yd of overburden and matrix per year. International owns and operates five large draglines, the newest of which is a Bucyrus-Erie 1250B, with a 235-ft reach, and a 26-cu yd. bucket—we call it the "Super Scooper," she succeeds our well known "Bigger Digger."

Human Engineering

At the American Mining Congress Cincinnati Coal Meeting, it was pointed out that we felt it well worthwhile to take a long look at any piece of machinery that cost well over $1,000,000, and was operated by one man! Here was our first try at the fresh perspective approach. First, we looked at our dragline operator's performance responsibilities and decided that in machines of this size and cost, some thought should be given to adapting the machine to the man. We wanted to do everything possible to make it easier for the man to get better performance from this $1,000,000-plus machine, and also to improve his yields from the valuable ore deposit which he was to dig. Further, there was more cost saving leverage to be gained through plant operating efficiency, since the dragline feeds a multi-million dollar beneficiation plant, which in turn establishes some of its own mining requirements.

The long list of improvements which are important considerations in adapting the machine to the man, so that he can do a safer, more precise job with instinctively directed motions that come naturally, do not need to be repeated here. This approach to equipment design is important to the mining industry, however, and encouragement needs to be directed towards voluntary modification by the manufacturer.

There are few mine operators who have a $1,000,000 machine-man opportunity for improvement such as we had, who therefore could afford to do this type of investigative design and development work. Further, we had the staff capabilities, an outstanding source of machine tool shop services, and we knew just the right consultants needed to carry out this project with minimum delay. We couldn't afford to wait for traditional shovel manufacturers to translate our competitive urge into their own areas of competition for machine-purchase-preference, and then to wait for the end results to get to us after full production design testing.

There are, however, innumerable opportunities, across the board, which can be considered to be "exclusively reserved" by manufacturers of mining equipment, opportunities to do the same thing to their labor saving equipment, where mine equipment costs range from $100,000 down. Such a cost area is usually prohibitive of development by the mine operator working alone. Continuous miners, jumbo drill units, undercutters, loaders and even the large off-highway type of trucks, scrapers, shovels, etc., with few notable exceptions, can all benefit by this newer perspective on the man-machine relationship.

A Fresh Perspective

There is no intention here to detract from the long standing alliance that has existed between the mine operator, the mine equipment supplier and the manufacturer. It would not have been possible to develop much of today's new equipment such as the continuous miner and the jumbo drill units, without these working relationships. What is needed, however, is a more effective working relationship. The mining engineer, using a fresh perspective approach to his mining problems, can contribute a great deal here to continue the historically downward trend of unit cost of mining.

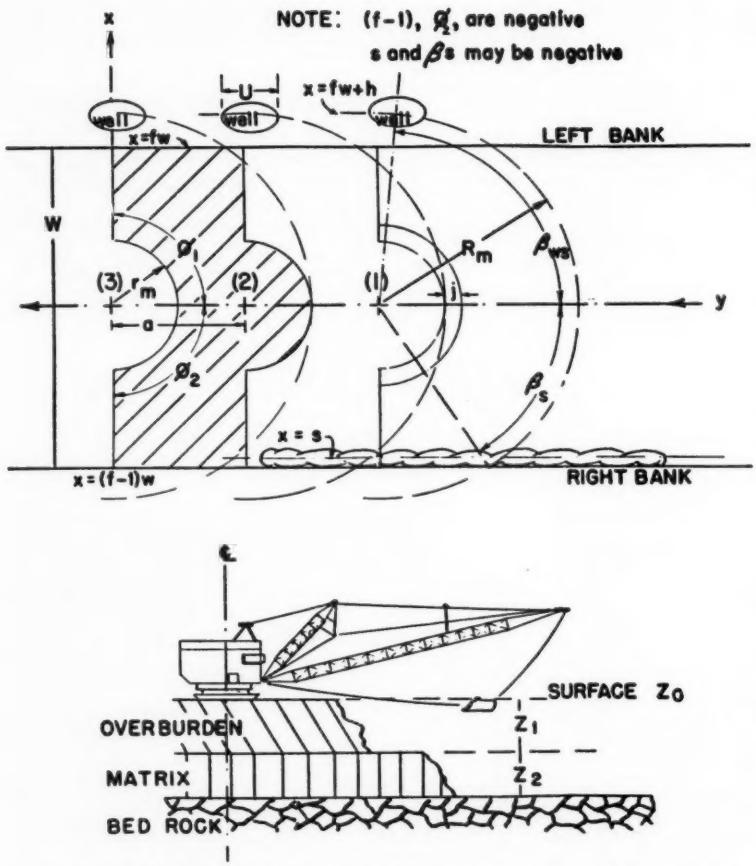
It's only logical that the day of the brute force type of Stutz-Bearcat controls should come to an end. There are still some manufacturers who need help to see this point. They need some better appreciation of the operator's problems and cost improvement opportunities. This is the new perspective that the mining engineer must supply. Sales are made on a service-to-buyer relationship, and manufacturers sometimes need encouragement from engineers who have a fresh outlook, who can point out the savings opportunities, the performance improvement advantages. We would still be driving black Model T's if it weren't for engineers alert to customer needs!

When use of this new perspective approach to engineering was first publicized, it couldn't be said that this work had paid off. Studies to prove such work, no matter how clear the logic and analysis may be, are often quite difficult. Fortunately, International gave the engineering department full rein to carry out exhaustive studies on the man-machine relationship in the design of a new dragline control cab and we now have definite evidence that this project is paying off.

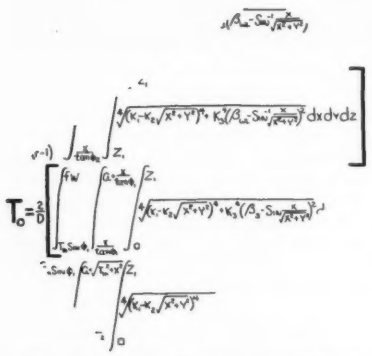
Pictures of yesterday's mining methods and equipment point up the progress we have made

Another New Frontier

At International we have done some more work with our draglines that should be of great interest to the mining community, more new work along the frontiers of engineering. We made an operations research analysis of dragline digging methods. This was our second try at the perspective approach. This will also lead back to the manufacturers and his equipment design, although it is such a new and interesting development that we have not yet had a chance to assess it sufficiently to report completely on it. We know that this new development is giving lower costs,



Raw materials of an operations research problem are the major variables of dragline operation



The process entails some complicated mathematics

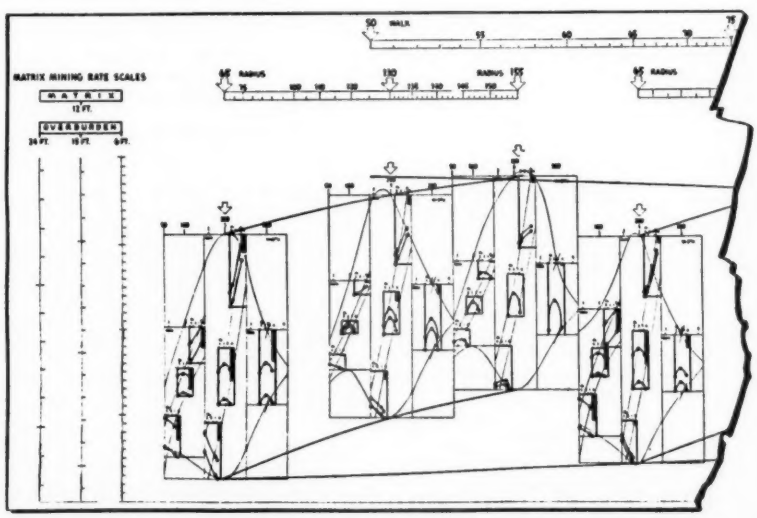
just as we know this about our other development, the new dragline cab.

Studies of the dragline not only sought to improve the control system of these large draglines, but they showed how sensitive we should be to the operating efficiency requirements imposed by such a capital investment, even should the machine be adapted perfectly to the man. In other words, supposing the ideal cab and controls were developed, what next?

The problem started very simply: upon an awareness of man-machine hours of availability and use. In this case, the capital investment was so high that maybe we should bring our Optimum machine utilization depends thinking into sharper focus by thinking solely in terms of machine-seconds. Then came another question: Shouldn't an investment like this operate under fairly rigid assignment to task? Surely this isn't the city steam shovel that puts on a show for the spectator, it's a deadly serious cost situation and each swing is very important.

Then the questions began popping up one after the other. How many swings does a typical machine make a day, roughly 1500? That's quite a lot, especially times 365 days per year! Should this dragline be allowed to walk just any old distance when it moves; shouldn't there be an optimum distance for it to move up on a working face? How long does it take to move, anyway, and what proportion is this to the working cycle, how related? What about the effect upon angles of swing—the angles to remove overburden, the angles to move matrix? How about moving the hydraulic sump to a better position? How about moving these sumps more often? How wide should a cut be, even if we've never dared question this before, since it had been established by other operating requirements.

We knew we had something here, when there were few questions that could be answered directly with the positiveness which we sought in the answers to these questions. Even so, all the answers were rule of thumb, born of time-honored experience. Don't depreciate this accumulation of fine experience, yet, to the inquisitive mind, out for a new approach to mining improvement opportunities, this type of finding is always like waving a red flag—a signal to dig into the matter.



The result is a chart showing how the factors contributing to dragline performance are related

Operations Research

Fortunately, we had very capable consultants working with us on our dragline control system. As it turned out, these people had exceptional mathematical abilities. The problem was to establish quantitative relationships between all of the factors which went into the digging operation, and it was to be solved by the most capable mathematicians, and by the most modern high-speed calculating equipment known. Dunlap and Associates of Stamford, Conn., handled this job all the way, from involved time studies to plotting the results so that they could be used. M.I.T.'s whirlwind, electronic digital computer, with its fantastic range of performance and speed, did the bulk of the mathematics.

Frankly, we did get into a theoretical study of the dragline operation. There was a "formula" developed covering dragline digging methods that involved the use of triple integrals, and a dozen different parameters—parameters being factors in the sense that they are complicated by a range of characteristics all their own, so that they can't be put down in simple x-y-z form. The mathematical equation, as expressed, takes several sheets of paper, and to get answers, the M.I.T. computer had to solve this intricate affair over 150,000,000 times, something like a 300 man-year computing task! In the end, we think that we may have been the first to have solved such a problem, involving so many unknowns, this being quite a feat in itself among mathematicians.

Unfortunately, at this time not all of the factors, parameters, the equation that was developed, nor the detailed results can be revealed, since this has become a valuable property of International, developed at expense to the corporation. But, a few of the results can be mentioned as they relate to the theme of this article to prove the value of a fresh perspective to develop new approaches to mining methods for lower costs.

Window Into the Future

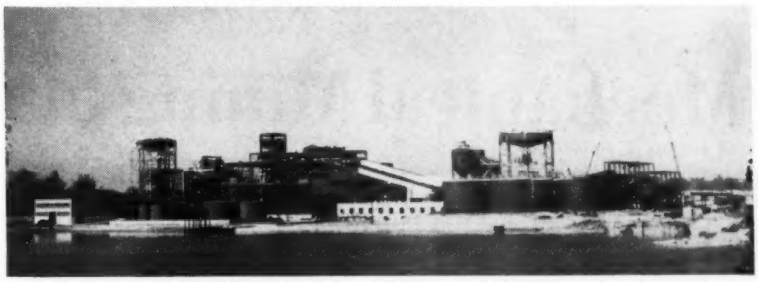
This was an *operations research* type of problem. It used today's, up-to-date scientific methods both in the approach to the problem and in the methods of its solution. The thinking in this work was different, and it not only came about as a result of a new approach to the mining methods question, but the results themselves have been equally productive of newer thinking about the dragline operation. It's as if we have a new window cut into a wall behind which there had been many unknowns. We now have a new tool with which to work. Determining the shape of the digging pattern to get optimum equipment performance; setting equipment performance standards; synthesizing of operating methods for cost comparative purposes; determining future equipment design dimensions and characteristics, and many other opportunities now exist for our mining engineers. Just the mere advantage of being able to have facts at our fingertips, in preference to intuitive judgment, has meant a lot to us.

Theory Has Its Place

Many practical old-timers are fond of warning that one should be careful of theory, that its application can get quite expensive and oftentimes winds up with spinning wheels and without sufficient reward. This is good advice. However, I should like to admit to my views on the approach to the mining methods studies presented here, because theory is so important to progress if we are to meet today's challenge. It is as though one considered the structure of a new building with all of its stairways, pipes, wiring, and communication lines to be the "theory." "Experience" fills in this structure to make this building livable and useful.

Operations research is like many other new developments that have come out of the past war to become useful to business. The machine tool industry has been one of the chief beneficiaries of operations research, but there is no reason why this science should not find wide application to the mining industry as well. Operations research has a valuable place from prospecting through mining, flotation and on into many other areas of management decision. This is especially true where quantitative measurement is needed to establish true values for decisions. We have found that this is one of the newest tools to give the engineer a clear perspective of the job, the relationship of the parts to the whole.

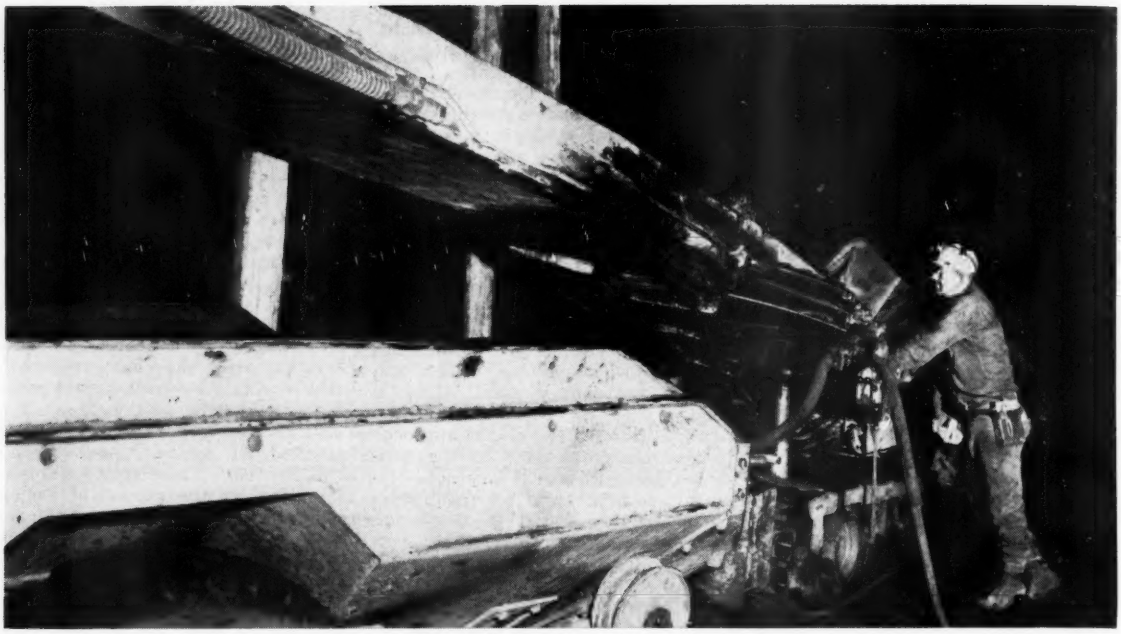
Progress such as we are making in operations research, however, would not be possible if it had not been for the continual encouragement and cooperative assistance from the experience men in the Phosphate Minerals Division, men who have not only been involved in these studies, but men who must put into practice the results of this work. Floyd Bowen, Manager, and Superintendents "Cap" Tillotson and Tom Smith, of the Florida production staff, have played an important part in this development. The span of company experience of over 61 man-years of phosphate mining, embodied in this team, aided this project by minimizing the time required to carry out investigation and to put results into practice. It was their experience, interpreted through intuitive judgment, that helped us to keep our goals in sight so that progress was made without real setbacks. Also, in a large corporation such as International, the fine cooperative relationship between management team in the field and the corporate executive staff group which originally sparked this research, deserves special mention. These relationships are important to the success of such an undertaking. Every step of the way, they showed how much this project just naturally belonged as a part of our operations, a feature which continually supplied the courage to persevere in spite of obstacles encountered.



One man on a million-dollar dragline must keep a multi-million dollar plant going

Conclusion

These two new developments at International, aimed at lower costs through the use of two newly developed sciences, have proven to our company that there is real opportunity for the engineer along the frontiers of engineering. We have found that human engineering and operations research have both definitely contributed to improved dragline operating efficiency. But what seems more important to us has been the satisfaction that goes with pushing out these frontiers of engineering to new limits. Specifically, what has been done at International's phosphate operations can be applied elsewhere to the mining industry. And while the beginnings of these two new frontiers in the mining industry have been modest at International, we think that ultimately these new methods should lead to considerable economy with increased productivity, that in time this will prove to be of real value to our industry and nation.



Mechanical loading in high coal

Mechanical Mining in Thick Seams

Pitching Coal Seam Up to 17 Ft Thick Under Heavy Cover Presents Special Mining Problems

By R. J. BOWEN
Mine Engineer
Columbia-Geneva Steel Division
U. S. Steel Corp.

COLUMBIA-GENEVA Steel Division of United States Steel Corp. operates the Columbia and Geneva Coal Mines in Carbon and Emery Counties, Utah, for the purpose of supplying coking coal to its steel plants near Provo, Utah. The mines are approximately 35 miles southeast of Price, Utah, and are served by the Carbon County Railway, operating between the mines and the Sunnyside branch of the Denver & Rio Grande Railway. Paved roads connect both mines with Highway 50 and 6 about 10 miles away.

Columbia Mine was opened in 1924 to furnish coking coal to the blast furnace at the Ironton Plant of Columbia Steel Co. near Provo which, incidentally, was the first successful blast furnace operation in the State since the pioneer endeavors at Cedar City from 1850 to 1883. The Columbia Mine was acquired by Columbia Steel Co., a subsidiary of United States Steel Corp., in 1930 and was mechanized with track-mounted equipment in 1938. Geneva Mine at Horse Canyon was opened in 1942 and was subsequently developed with track and shaker equipment for shaker mining by the Government's Defense Plant Corp. The purpose of this venture was to furnish coking coal mainly for the Geneva Steel Works, which was then under construction by the Defense Plant Corp. at Geneva, Utah. The Government continued to operate Geneva Mine until it was purchased by U. S. Steel Corp. along with Geneva Steel Works in 1946. Since that time track and shaker mining machinery in both mines have been replaced with off-track mobile equipment.

Geology and Seam Conditions

The coal field is known as the Book Cliffs. It is contained in the Black Hawk Formation of the Mesa Verde Group, which is Upper Cretaceous in age. At the location of the mines there are two seams, the Lower and the Upper Sunnyside. All production comes from the Lower Sunnyside, which in general is 14 ft thick with local variations, and ranges from eight to 16 ft. The Upper Sunnyside is from two to three ft thick and is most commonly found two to three ft above the Lower Sunnyside. This separation, however, varies greatly. In some places it may be as much as eight ft, while in other areas the two seams are together, making a total thickness of 17 ft. Again, in some areas the Upper Sunnyside seam is nonexistent. The exposed seam in most places has burned, forming red stained rocks high on the face of the Book Cliffs.

The seam pitches 11 to 20 percent to the east under rough mountainous terrain. Depth of cover over present mine workings ranges from 200 to 2500 ft. The seam persists, however, to unexplored depths. In addition to the adverse effects of steep pitches, the beds are displaced by numerous faults. There is no regular pattern or system apparent in this faulting, which has had an unpredictable influence on the layouts and development of the mines. Mining districts are often bounded by the faults and the mining plans are made in accordance with them insofar as they are known and can be projected.

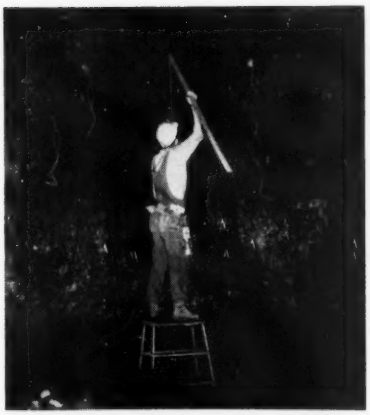
The immediate stratigraphy has an important bearing on mining the Lower Sunnyside seam, which rests

on a hard firm sandstone approximately 50 ft thick. This, in addition to six in. of hard high sulphur coal which is left on the bottom, forms a good roadbed for off-track mobile equipment. The rock between the two seams changes in both thickness, composition, and character of bedding. Thus roof conditions change abruptly making it necessary to rely on experience in deciding the degree of roof support over and above minimum standards. The main roof above the Upper Sunnyside is most often composed of sandstone laminated with thin carbonaceous shale bands.

Coal from both mines is unwashed. The only cleaning received is from hand picking within the mine and at the tipple. To date the ash and sulphur contents have been reasonable and are currently running approximately 7.4 percent and one percent, respectively. However, as the mines extend more rock bands are being encountered and washing will become necessary at some future time.

The mines are relatively dry. At times during dry seasons the mine drainage has to be supplemented in the Columbia Mine to furnish sprinkling needs. The Geneva Mine pumps approximately 100 gpm normally in excess of sprinkling needs; however, this may vary according to annual fluctuations in precipitation.

Power is purchased from Utah Power & Light Co. at 44,000 v. It is stepped down to 4160 v at Columbia and to 2300 v at Geneva Mine for distribution to the underground substations located near the respective load centers. At these substations the power is converted to 275 v d-c for haulage and district mining use by either ignitron rectifiers or motor-generator sets operating in parallel.



Even tamping can become a problem

Mining Plan at Geneva

Since methods and equipment are the same at Columbia and Geneva Mines, further reference will be to Geneva Mine.

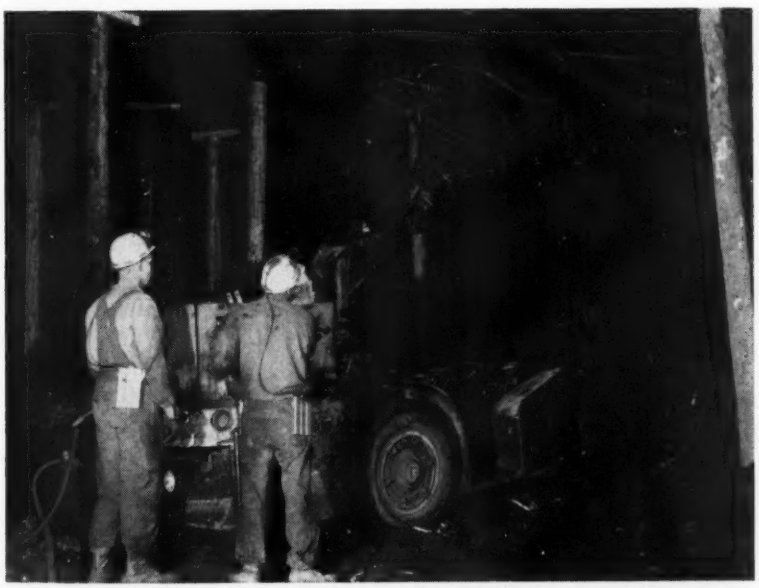
Ventilation of Geneva Mine is induced by three 84-in. axial flow fans operating as exhausters. At the present time these fans are expelling a combined volume of 600,000 cfm at an average pressure of 1.4 in. water gauge. The mine is classed as nongassy, but the same precautions are taken as though it were gassy.

Geneva Mine was opened by strike entries driven into the outcrop at its intersection with the bottom of Horse Canyon. These entries were extended both to the north and to the south. At 1000 ft from the south portal the main slope was driven to open the mine at depth. From the slope, strike entries were driven at intervals of one-half mile. This plan of development contemplated a layout for the raise districts to accommodate shaker conveyor mining. Haulage by locomotives along the strike entries terminates at the slope, where the coal is dumped from the cars by two rotary car dumpers and discharged onto a 54-in. belt conveyor, which transports it to the surface transfer house. The coal is there reduced to 7 in. by 0 by a primary double roll breaker. A 48-in. belt conveyor then transports it the 0.6 of a mile to the tipple.

Men and materials are transported to and from the lower points of the mine by a 500-hp hoist. The hoist also hauls the coal from below the second level to the rotary dump stations.

Two mining layouts are in use at Geneva Mine. They are distinguished by the method of approach and are locally known as the raise or dip districts, depending on the type of haulage. The raise districts are developed up the pitch from the main strike entries with belt conveyor haulage to the main motor road. The dip method uses locomotive district haulage from rope terminals or partings off a slope. The general progress of development is down the pitch.

Advantages and disadvantages of the raise district compared to the dip district are numerous, involving the relative merits of belt versus car haulage, which at Geneva Mine are influenced by the pitch of the seam and faults. A combination of the two methods has offered advantages to date. Although belt district haulage down the pitch is efficient and safe on the steep grades, delivery of materials is slow and cumbersome.

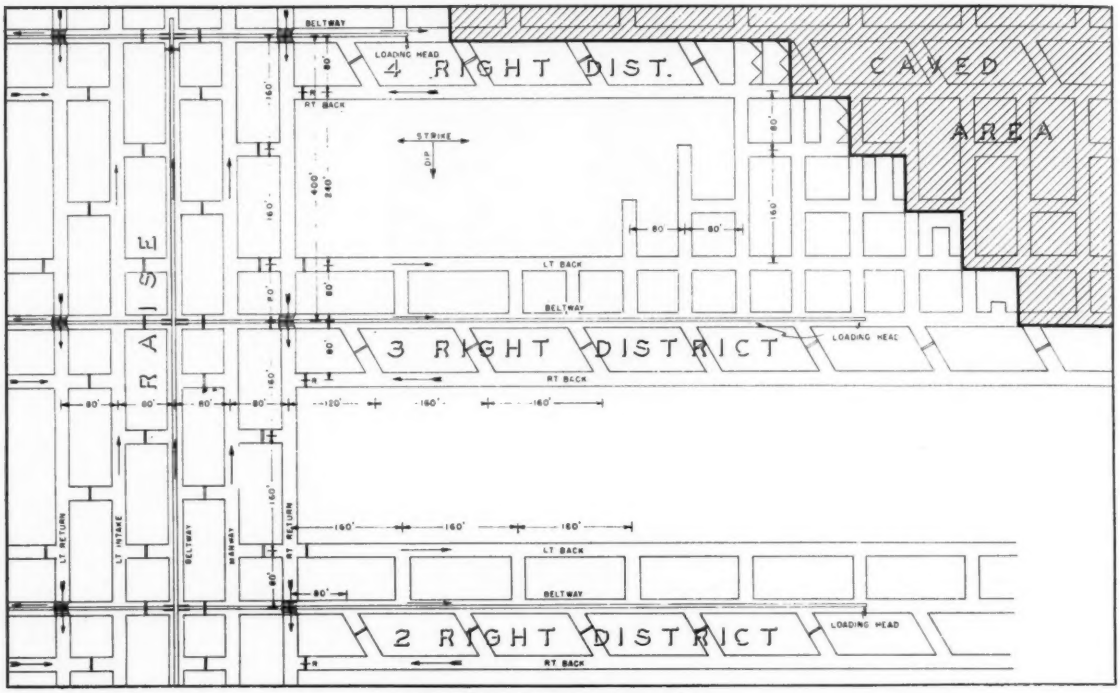


The thick seam suggested machines with a wide range of manipulation

Contend With Steep Grades

The same conventional trackless mobile equipment is used in both raise and dip districts. The ordinary machinery complement for an operating unit consists of: one rubber-tired cutter with mounted hydraulic coal drill, one large crawler-mounted loader, two seven-ton capacity shuttle cars, and auxiliary equipment such as elevating conveyors, portable high pressure rock dusters, stub-end breakers, etc. Here again natural conditions have a great influence on equipment requirements. Until recently the most powerful shuttle cars available were grossly underpowered.

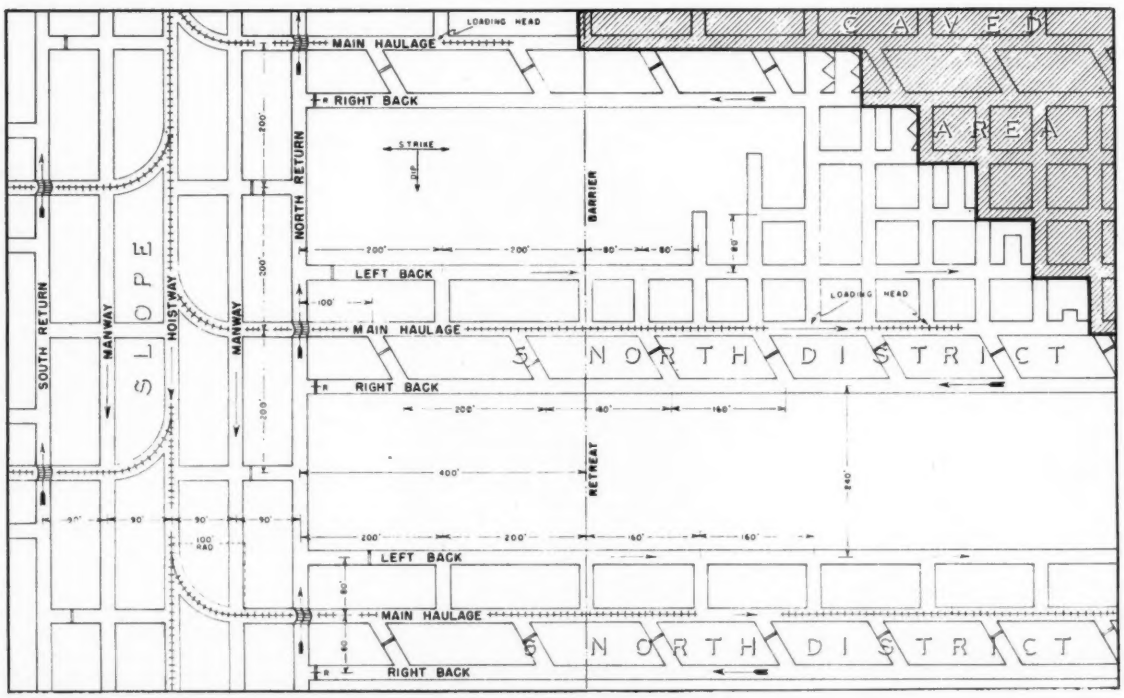
The steep grades also require more braking features and power than is ordinarily provided as standard by manufacturers. Reliable dynamic and mechanical braking are essentials on shuttle cars. Loaders and cutters must have convenient quick-acting mechanical emergency brakes capable of stopping and holding the machine on grades up to 20 percent. In addition to adequate braking the machines must have the power to tram up or



Method of mining in raise districts

down the pitches at reasonable speeds to avoid delays. It often happens that when there is enough tramming power, traction is insufficient, especially with loaders and cutters. There is little difficulty in this respect with the four-wheel drive shuttle cars.

The thick seam suggested specifications for higher manipulating ranges. For example, some of the cutting machines are capable of cutting level, 13 ft above the floor line. Also recent cutters purchased are equipped with bugdusters and self-spotting coal drills capable of drilling a nine-ft hole. This machine enables the operator to cut and drill a high face with little exposure to his assistants. This machine, in addition to the safety advantage just mentioned, leaves cleaner kerfs and reduces the drilling time to ap-



Dip districts are mined according to this plan

proximately one-half that required by the ordinary machine with four-ft drill range and no bugduster. The extra man required to niche the face to facilitate collaring the holes, change augers, and shovel bugdust has been eliminated.

Roof Problems

Roof bolting as an aid to roof support is increasing in scope. This is especially true in pillar mining where the immediate roof members are pinned to reduce weakening until the expected coal recovery is accomplished. Trials have been made to bolt top coal, but in pillar places this has not been successful. When the weight comes the coal either spalls out from around the bolts, or along the ribs until there is little if any strength in the remaining top coal beam. Actually, in some cases the top coal had to be taken down or timbered with crossbars after roof bolting. Therefore, in the mining places the practice is to bolt the rock band between the two seams. This normally requires a six-ft bolt to anchor in the main roof, although local variations may require bolt lengths from four to nine ft.

Many different type roof bolts have been tried, but the one giving the most consistent satisfactory results has been the one-in. diameter split-wedge type. In bolting, a hard, firm rock member is selected for anchoring. A 1⅜-in. hole furnishes the best anchor. Tests show that with 300 ft lbs of torque, anchorages withstanding seven tons of pull are normally attained.

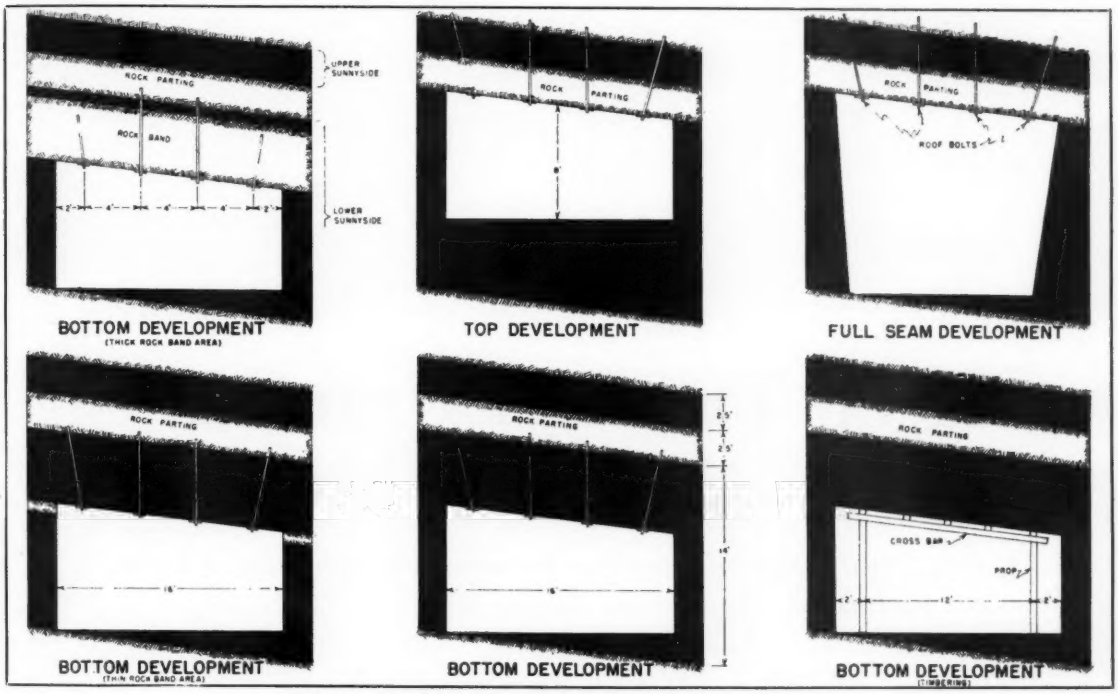
Pillar Recovery

A balanced system of room and pillar mining is now practiced. Roof control, insofar as natural conditions will permit, is accomplished by keeping solid blocks of coal near the working area and maintaining the cave line at 45° to the strike. All entries, rooms and cross-cuts are on 80-ft centers or multiples of 80 ft to furnish a systematic pattern for both advance and pillar work. Rooms are driven 18 ft wide and slough to about 20 ft. Pillars are split so that all are approximately 60 ft by 60 ft in size before they are split again in final extraction, leaving two curtain pillars 60 ft by 20 ft. These are further reduced to triangular-shaped stumps, generally small enough to crush under the accumulating weight of the advancing cave. However, if in the opinion of the supervisor they are too large and may hinder caving, they are drilled and shot to further weaken them and thereby induce caving. Some development cross-cuts are on 45°. This is to reduce the adverse grade against the shuttle car haul from the lower entry which is used as a return aircourse.

Recovery of top coal lends its special problems. At best there is always some loss and as much of it is recovered as is consistent with good judgment in safe mining. When the top coal is fractured, or the accumulating weights cause it to yield, it is taken down in advancing the rooms or pillar splits. Props are generally sufficient although cross-barring has often been necessary to hold the rock band and Upper Sunnyside coal seam. Recently roof bolting has become a valuable aid in top coal and pillar recovery. This practice is expanding as roof bolting machines capable of bolting at these heights are provided.

Bench Mine in Places

In some districts, especially under heavy cover, the ribs of the openings slough badly. To reduce this hazard the entries or rooms are driven in the top portion of the seam with bolts providing the main means of roof support. The remaining coal is then recovered by cutting and shooting up the bottom, starting up the pitch to get to the floor of the seam quickly. To date several development entries have been driven off bottom, but only one district is using this system, largely as an experiment in pillar recovery. The results of this experiment have been most gratifying in regard to good rates of production possibilities, safety, and coal recovery. It happens that this particular district is under low cover (850 ft), but the same relative advantages, to a greater extent, are believed to be applicable under heavy cover. It is also believed that continuous mining machines can be applied to good advantage in this off-bottom method with roof bolting under the conditions found in Columbia and Geneva Mines.



Various types of roof bolts and bolting systems have been tried

Accounting for every pound of uranium ore mined is important

Keep Track of Uranium Production and Reserves

Uranium Ore Production and Ore Reserves of Western United States, Methods of Compilation, Classification and Calculation

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MAINTAINING a record of uranium ore production and reserves for the Western States is a task shared by the Accounting and Ore Reserves Branches AEC in Grand Junction. The increasing numbers of uranium mines being discovered and shipping ore since 1951 have raised problems regarding rapid, efficient accounting. Accordingly, during the past two years these branches of the AEC's Grand Junction Operations Office developed a series of periodic ore production summaries initially, and a group of quarter-year ore reserve reports facilitated by the use of punch card equipment furnished by International Business Machines Corp.

Receive Data Monthly

Ore receipts and stockpile data are submitted to the Accounting Branch on a monthly basis by the uranium mills and buying stations. Newly discovered reserves, increases, and occasionally decreases in reserves already developed are forwarded to the Accounting Branch by the Ore Reserves Branch in Grand Junction and the Denver and Salt Lake Exploration Branches on a quarter-year basis.

Companies Supply Drill Data

The Mineral Deposits Branch of the U. S. Geological Survey, the Exploration Division and branches of the Atomic Energy Commission, and the Mining Division of the Grand Junction Operations Office contribute ore reserves estimates covering U.S.G.S. and A.E.C. drilling projects and A.E.C. mine leases and mine examinations for certification to receive the initial production bonus, Domestic Uranium Program Circular 6. The major sources of successful drilling data from which ore reserves have been compiled during the past two years have been the mining companies, large and small, engaged in uranium exploration.

From all this material are processed one-, three-, and twelve-month ore production reports and three-month

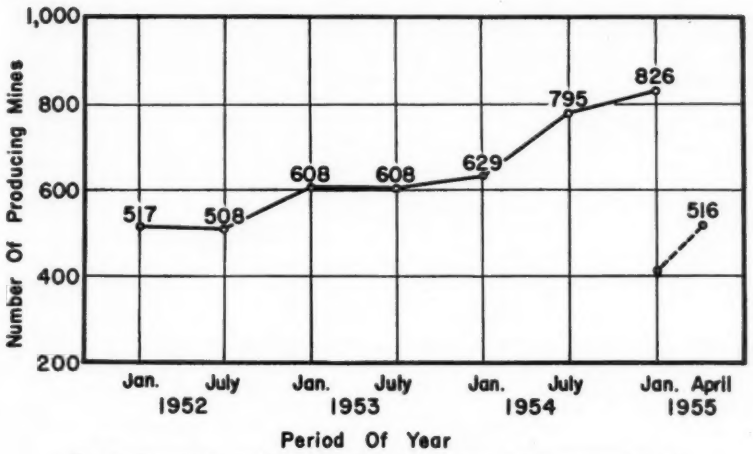

Fig. 1—Increased numbers of uranium mines complicated accounting job

ore reserve balances for each active mine and each inactive mine with current reserves. Ore production for the past quarter-year is subtracted from the reserve balance of each property at the end of the previous quarter-year or from revised reserve estimates of properties with reserves increased or decreased during the period.

The following IBM equipment is used in the processing of ore production and ore reserve data:

(1) Card punch—this machine has a keyboard similar to a typewriter keyboard and is used to transcribe manually source information onto tabulating cards in punched hole form.

(2) Sorter—used to arrange cards in sequence according to the codes punched in the cards.

(3) Collator—this machine is capable of comparing the codes contained in two files of cards simultaneously and performing such operations as merging or filing, matching identical items, and selecting separately out of two files items which are not common to both.

(4) Alphabetical accounting machine—all printed reports are prepared on this machine. Contacts through the holes punched in tabulating cards initiate electrical impulses which actuate the type bars and counter units. This machine prints alphabetical and numerical data, one horizontal line per tabulating card, simultaneously, with a maximum spread of 80 digits per line at the rate of 80 cards per minute, a printing output of 6400 characters per minute.

(5) Summary punch—this machine is connected electrically to the accounting machine. When a total is printed by the accounting machine, a card is automatically punched and printed showing that total.

(6) Calculating punch—this machine reads factors from tabulating cards and will add, subtract, multiply, and divide as required, expressing the result in punched holes, either on a card-by-card basis or on a summary card at the end of a group of cards.

Each Mine Has Code Number

Each mining claim or group of claims is assigned an identification code number which is used in all processing of ore production and ore reserve data. These numbers are assigned in such a manner that arrangement of a file of tabulating cards in numerical sequence will develop alphabetical sequence by claim name.

The Ore Reserves Branch reports to the Accounting Branch changes in the reserve balances for previously developed properties, and reserve accounts for newly developed claims. These changes may consist of revisions in tonnage, grade, or any other of the numerous classifying codes. The cards in the reserve balance file are changed to agree with these data.

A cutoff date for these changes to the reserve balance file is established, effective prior to completion of the recording of a quarter year of ore production. The reserve balance file at this point is referred to as the *beginning balance* for a quarterly processing cycle.

Ore production for the quarter is recorded on tabulating cards, three cards for each producing claim. The first card records the tonnage, contained pounds, and grade in percent of U_3O_8. The second and third cards show the same information for V_2O_5 and $CaCO_3$. Common to all cards are claim name and mining district identification codes, among many classification codes used.

The reserve balance file or beginning balance is maintained in claim code sequence for each mining district. The production cards for the quarter are mechanically sorted into the same sequence.

In the collating machine, ore production cards which show claim and district codes identical to items on the cards in the reserve balance file are matched in pairs. Production cards which do not match reserve balance cards are set aside. Reserve balance cards for which there are no current ore production cards to match are also set aside. This wholly mechanical operation is performed at the rate of 240 sortings per minute. The sorted cards are thus divided into three categories to show:

(1) Mines with reserve balances from which production is to be subtracted.

(2) Mines with production for which no reserve balance has been reported.

(3) Mines with reserve balances but not in production during the period.

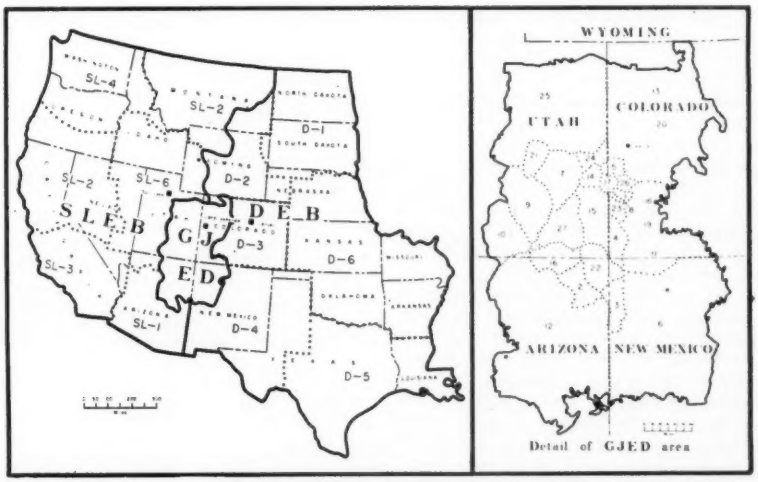

Fig. 2—Areas of activity of AEC exploration offices in Denver, Salt Lake and Grand Junction

Fig. 3—Stratigraphic Classification of Bedded Uranium Deposits of the western United States

Name of Significant Host Rock	*Geologic Age of Host Rock*
Bidahochi, Browns Park, White River, Wind River, Uinta, Wasatch, Fort Union (Tongue River, Ludlow)	Tertiary
Mesaverde, Dakota, Inyan Kara (Fall River, Lakota)	Cretaceous
Morrison (Brushy Basin, Westwater, Salt Wash)	Jurassic
Summerville, Todilto	Jurassic
Entrada	Jurassic
Chinle, Shinarump	Triassic
Cutler, Deer Trail	Permian-Cambrian
Dripping Spring	Pre-Cambrian
Vein type and miscellaneous	....

First, the cards with reserve balances from which production is to be subtracted are run through the accounting machine and electrically connected summary punch. Tonnage of ore produced is automatically subtracted from the total reserve tonnage for each claim. This production is also subtracted from the indicated reserves for each claim. If the subtraction from the indicated tonnage results in a credit or negative tonnage, the amount of the credit is subtracted from the inferred tonnage.[1] Simultaneously, new balance cards are created automatically by the summary punch machine complete with resultant tonnages of ore and other coded detail. Groups of three cards with beginning reserve balance, matched production, and the new reserve balance for each producing mine are now placed in the calculating punch machine and current grades in percent U_3O_8, V_2O_5, and $CaCO_3$ are computed from net tons and net pounds of contained products and punched automatically in the new balance cards.

Second, the cards for mines in production with no reported reserves are run through the accounting machine and a listing of this production by claims within mining districts is printed and sent to the Ore Reserves Branch.

Third, the cards for mines with reserves from which there has been no current production are reproduced in the summary punch to create a duplicate set of cards for the ending balance file. This, too, is a completely mechanized operation.

All cards—production, beginning balance, ending balance—of the three categories described above are now arranged by claim codes within mining districts, and a detailed listing is run, showing for each claim the tonnage of ore produced with grade U_3O_8, V_2O_5, and $CaCO_3$, the beginning and ending balances of indicated, inferred, and total reserves. This listing is transmitted to the Ore Reserves Branch for analysis and review.

The ending balance reserve cards are now extracted from the other cards in the sorting machine, and tonnage and average grades of U_3O_8 and V_2O_5 for each mining district are automatically computed on the calculating punch machine.

The ending balance reserve cards are now available for further summarization by any of the classification codings entered on the cards using the calculating punch machine.

In addition to the IBM production-reserve cards maintained by the Accounting Branch, the Denver, Salt Lake, and Grand Junction Ore Reserve offices maintain Keysort reserve-production cards, 8 in. by 10½ in. in size, on which are posted the quarter-year summary data for each property as compiled by IBM. These Keysort cards constitute immediately available individual chronological records of the reserves and production for every mine in contrast with the IBM cards, which are used periodically to report automatically the *current* status of all the mines in sequence.

Classification

IBM and Keysort cards are both designed to yield the following information:

Name of claim or group of claims
Name of ore shipper and nature of property ownership

The United States Government, each individual uranium milling company, and all independent claim holders as a group are identified. The milling companies, known as

Fig. 4—CLASSIFICATION OF URANIUM ORE RESERVES ACCORDING TO MINING AND METALLURGICAL AVAILABILITY AND HIGHWAY ACCESSIBILITY

	Mining	*Metallurgy*	*Access*
MINING			
The mineral deposit can be mined profitably under Schedule I, Circular 5, Revised, excluding the haulage allowance	A		
The mineral deposit cannot be mined profitably under Schedule I, but could be profitably mined with the addition of the payments as scheduled for the Initial Production Bonus, described in Section 60.6 (d), Circular 6	B		
The mineral deposit could be mined profitably only if the base price, as described in Schedule I, Circular 5, Revised, was tripled	C		
The mineral deposit could not be mined profitably even if the base price was tripled	D		
METALLURGY			
The ore is amenable to presently available mill circuits and equipment		A	
The ore must be blended in lesser amounts with amenable mill feed or straight ore can be treated with minor revisions in mill circuit		B	
The ore is not acceptable for milling. The mill must be completely revised to handle feed or the ore is not amenable to any present milling process		C	
ACCESS			
The haulage distance from the mine to the nearest purchase depot that will accept the ore is 100 miles or less. The cost of such haulage does not exceed 6 cents per ton mile			A
The haulage distance from the mine to the nearest purchase depot that will accept the ore is 100 miles or less. But the cost of such haulage exceeds 6 cents per ton mile			B
The haulage distance from the mine to the nearest purchase depot that will accept the ore is greater than 100 miles. Access to the mine is satisfactory			C
The haulage distance by road and rail from the mine to the nearest purchase depot that will accept the ore is considerably greater than 100 miles. A fringe area contract is necessary to provide satisfactory access			D
Available	A	A	A/
		B	/D
Borderline		A	A/
	B	B	/D
	A		A/
Not available	B	C	/D
	C	A/	A/
	D	/C	/D

[1] *Indicated ore plus Inferred ore equals Total* ore developed. These terms are defined under *Classification*.

unit price contractors are: The Anaconda Co., Climax Uranium Co., Kerr-McGee Oil Industries, Inc., Mines Development Co., Mining Research Corp., U. S. Vanadium Co., Vanadium Corp. of America, Vitro Uranium Co.

State, county, mining district, and locality in which the deposit is located

Formation or group of formations in which the ore deposit occurs. See Figure 3

Delivery point to which ore is shipped and the road mileage to that point or to a railhead

Delivery points, either mill or buying station are: Bluewater, N. M.; Durango, Colo.; Edgemont, S. D.; Globe, Ariz.; Grand Junction, Colo.; Marysvale, Utah; Naturita, Colo.; Monticello, Utah; Rifle, Colo.; Riverton, Wyo.; Salt Lake City, Utah; Shiprock, N. M.; Thompsons, Utah; White Canyon, Utah

Source and method of discovery and development of the deposit

The sources are identified as Atomic Energy Commission, United States Geological Survey, Defense Minerals Exploration Administration, and private operators. The methods are identified as drilling, mining, and surface or airborne prospecting.

Depth of burial in feet for relatively flat-lying bedded deposits

Increments of 50 ft are used.

Thickness in feet of ore deposit

Increments of one ft are used.

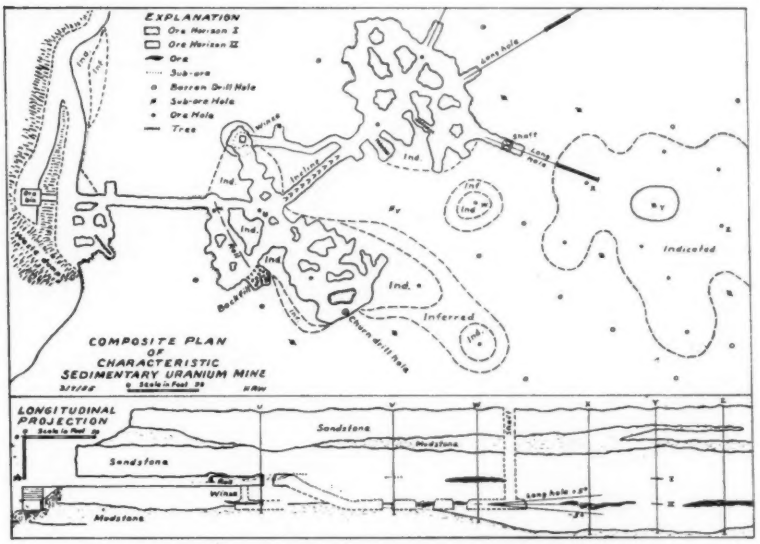

Fig. 6—Indicated and Inferred ore are recognized by AEC

Mining and metallurgical availability and highway accessibility

Classified and defined in Figure 4.

Metallurgical type of ore

Tabulated in Figure 5.

Tons of ore, pounds and grade in percent of U_3O_8, V_2O_5, and $CaCO_3$ for indicated, inferred, and total ore reserves and for ore production

Two classes of developed ore reserves are recognized by the Atomic Energy Commission, as illustrated in Figure 6.

Indicated Ore. Is ore for which tonnage and grade are computed partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on geogical evidence or experience. Because of the erratic variations in thickness, grade, and continuity of ore characteristic in uranium deposits, the relatively small quantity of ore which could be considered as measured ore is included with indicated ore. The estimate of contained U_3O_8 should not vary more than 10 percent from the quantity eventually realized.

Inferred Ore. Is ore for which quantitative estimates are based on limited exposures or an assumed continuity or projection which can be justified either by geologic evidence or by comparison with deposits of similar type. The estimate of contained U_3O_8 should not vary more than 20 percent from the quantity eventually realized.

In addition to all the classifications previously described, the Keysort card also reveals the following information:

Name of property owner

Location of property with respect to section, township, range, and meridian

Projected estimate of tons of ore and grade in percent of U_3O_8 and V_2O_5 for undeveloped potential ore

Potential Ore. Is ore not yet discovered in areas containing known deposits. Projections may be confined to several hundred feet or more in the instance of vein type deposits or isolated sedimentary deposits, or to sev-

Figure 5

Metallurgical Amenability of Types of Uranium Ore at Present and Proposed Mills

No.	Type	Bluewater	Gr. Junction	Monticello	Shiprock	Rifle	Uravan	Durango	Naturita	Salt Lake City	Edgemont	Moab
1	Pegmatite	B	C	B	B	C	C	C	C	B	B	B
2	Primary vein pitchblende, no visible sulfides	B	C	B	B	C	C	C	C	B	B	B
3	Pitchblende with other metals, scattered sulfides	B	C	B	B	C	C	C	C	B	B	B
4	Pitchblende with other metals, many sulfides	B	C	B	B	C	C	C	C	B	B	B
5	Uranophane	A	C	A	A	C	C	C	C	A	A	A
6	Uraniferous fluorite	C	C	A	C	C	C	C	C	A	A	A
7	Autunite	A	C	A	A	C	C	C	B	A	A	A
8	Schroeckingerite	C	C	A	C	C	C	C	C	A	A	C
9	Roscoelite	B	A	B	A	C	A	C	A	A	B	B
10	Carbonaceous shale	C	C	B	C	A	C	A	C	A	B	C
11	Carnotite, low vanadium, low lime	A	A	A	A	A	A	A	A	A	A	A
12	Carnotite, low vanadium, intermediate lime	A	B	A	A	B	B	B	B	B	A	A
13	Carnotite, low vanadium, high lime	A	C	A	A	C	B	C	A	C	A	B
14	Carnotite, high vanadium, low lime	A	A	A	A	A	A	A	A	A	B	A
15	Carnotite, high vanadium, intermediate lime	A	B	A	A	B	B	B	B	B	A	A
16	Asphaltic type, low vanadium, low lime	C	B	B	C	B	B	B	B	A	C	C
17	Asphaltic type, low vanadium, intermediate lime	C	B	B	C	B	B	B	B	A	C	C
18	Asphaltic type, high vanadium, low lime	C	B	B	C	B	B	B	B	A	C	C
19	Asphaltic type, high vanadium, intermediate lime	C	B	B	C	B	B	B	B	A	C	C
20	Copper-uranium shale	B	C	B	B	C	C	C	C	C	B	B
21	Copper-uranium sandstone	A	C	A	A	C	C	C	C	C	A	A
22	Uraninite, low vanadium, low lime	A	A	A	A	A	A	A	A	A	A	A
23	Uraninite, low vanadium, intermediate lime	A	B	A	A	B	B	B	B	B	A	A
24	Uraninite, low vanadium, high lime	A	C	A	C	C	C	C	C	C	A	C
25	Uraninite, high vanadium, low lime	A	A	A	A	A	A	A	A	A	A	A
26	Uraninite, high vanadium, intermediate lime	A	B	A	A	B	B	B	B	B	A	A
27	Uraniferous lignite	C	C	C	C	C	C	C	C	C	C	C

Low vanadium <0.75% V_2O_5 — Low lime <6% $CaCO_3$
Intermed. lime 6–18% $CaCO_3$
High vanadium >0.75% V_2O_5 — High lime >18% $CaCO_3$
V_2O_5 recovery not considered

eral miles in the instance of deposits related to geologic structures or deposits in formations with local favorability. The estimate of contained U_3O_8 should not vary more than 50 percent from the quantity eventually realized.

Calculation

A large proportion of the uranium reserves of the western United States has been initially developed by exploration drilling rather than by mining. Accordingly, this discussion is concerned primarily with reserve estimations for flat-lying sedimentary deposits which are singularly well adapted to drilling from the surface.

Hole spacing and area of influence per hole present some of the major problems in ore reserve calculation. The degree of certainty of realizing in mining the estimates that are calculated on paper is most important.

Indicated ore is blocked out by *development* drilling with patterns of drill holes wherein the approximate areal shape and the more definite grade of ore are all delineated. Continuity of ore with respect to thickness-grade from hole to hole must be dependable before economic evaluation of an individual drilled deposit can be significant.

Inferred ore is considered to be present in remotely isolated single *exploration* drill holes and in extensions between development drill holes in a pattern that does not possess continuity of ore between adjacent holes. In the latter instance the hole spacing pattern is too wide to reveal the shape and size of individual ore bodies or else the deposits are too small to reveal their areal shape in the pattern drilled.

As a general rule the Grand Junction Operations Office considers an approximately equal ratio of indicated to inferred ore the practical compromise between high degree of certainty of tonnage and grade of ore and high cost of development drilling prior to mining evaluation.

In the Salt Wash member of the Morrison formation, development drilling patterns used by the Atomic Energy Commission and U. S. Geological Survey have varied in hole spacing with centers of 20 to 25 ft for a minimum and 150 to 200 ft for a maximum.

In the minimum instance, an ore body about 1.5 ft thick, containing several thousand tons of nearly marginal ore, assaying 0.23 percent U_3O_8, was penetrated by a large number of holes with average depth of 53 ft. In the maximum instance, a deposit containing several hundred thousand tons of commercial ore about 3.5 ft thick, assaying in excess of 0.35 percent U_3O_8, penetrated by a comparable number of holes with average depth in excess of 650 ft.

Average area of influence per drill hole for ore in the Salt Wash sandstone is about 25 ft of radius, or about 50 ft between drill hole centers. In the Chinle formation near Big Indian Wash in southeastern Utah, where large ore bodies are common, drill hole centers are spaced satisfactorily 100 to 200 ft apart. In the Shinarump formation of the White Canyon and Monument Valley districts, fence lines of holes are drilled normal to the axes of the ancient stream channels. Here the area of influence of drill holes varies from a maximum elongation of about 50 ft parallel with a channel to a minimum elongation of about 25 ft normal to the channel. In thin but persistent uraniferous lignite deposits of Harding County, S. D., the unit of one acre per drill hole is being considered.

Individual area of influence or equal area of influence per drill hole can be used to calculate the tonnage and grade of flat-lying sedimentary uranium deposits. If the dispersion of drill holes is systematic within individual ore bodies, the simpler of the two methods, using equal area of influence per drill hole, is sufficiently accurate.

The minimum thickness-grade cutoff for uranium ore used by the Atomic Energy Commission is 0.10 ft-percent U_3O_8 with minimum thickness of 0.1 ft and with minimum

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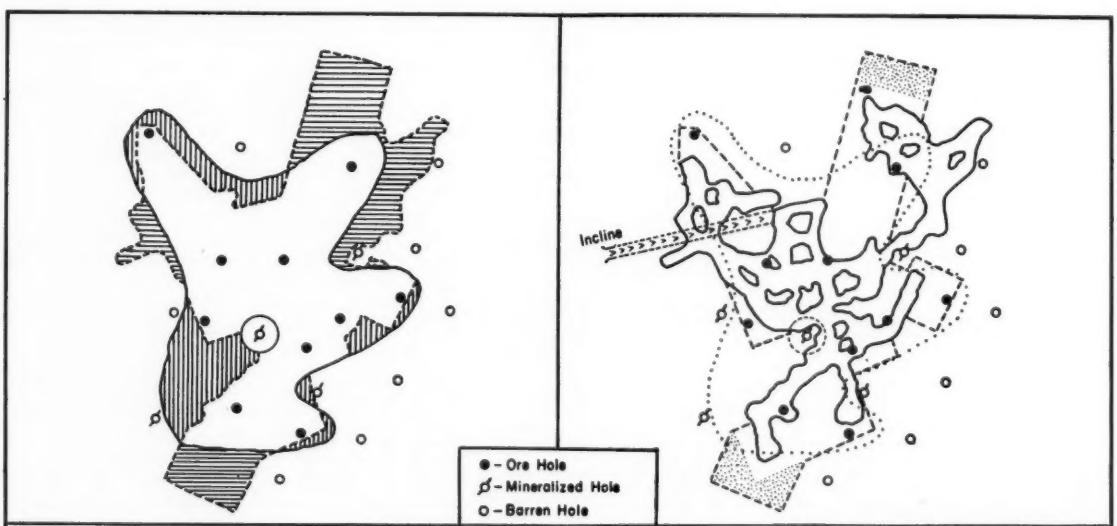
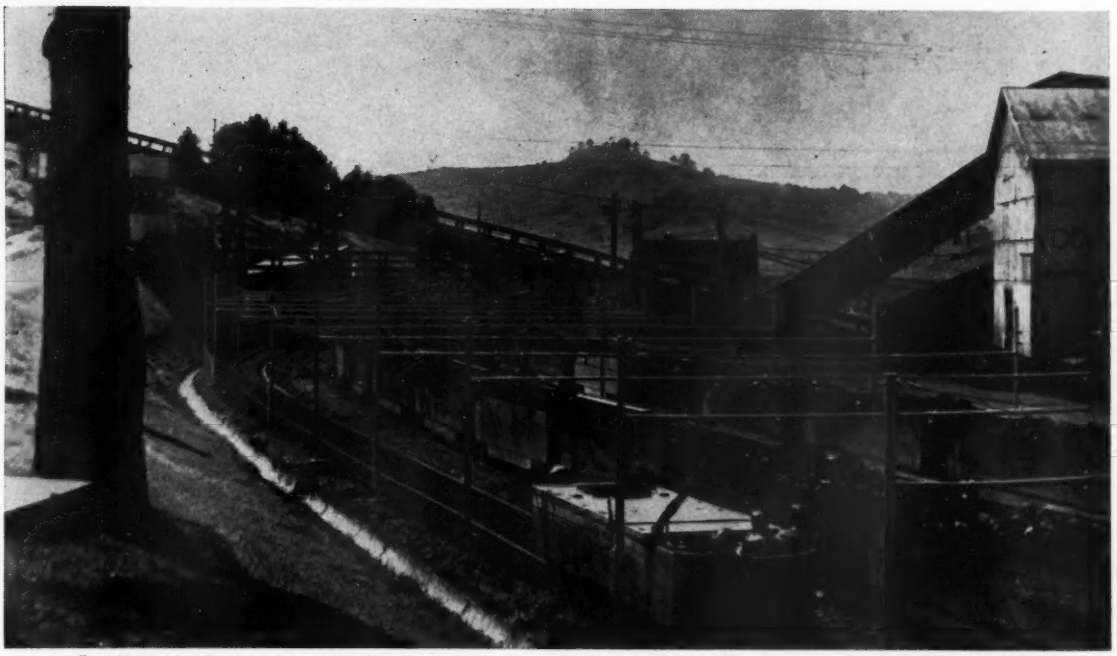


	Tons
Area of ore body after completion of drilling, containing	3,740
Areas shown by mining to contain additional reserves	680
Areas shown by mining to contain low grade or waste	490
Net gain	190

	Ore Tons	Percent U_3O_8	Percent V_2O_5	Pounds U_3O_8	Pounds V_2O_5
Original ore reserve estimate	3,740	0.37	2.47	27,676	184,756
Production to date, 5/1/54	3,783	0.19*	2.01	14,593	152,163
Ore reserve balance				13,083	32,593
Realization before re-examination		101%		53%	82%
Current ore reserves	1,651	0.39	2.32	12,878	76,606
Production + current reserves	5,434	0.25	2.10	27,471	228,769
Anticipated realization		145%		99%	124%

*To date on overall dilution with waste of 92%

Fig. 7—Ore realized exceeds original estimate



An efficient haulage system maintains the flow of all required material at minimum cost and with maximum safety

Considerations in Designing a Mine Haulage System—Part 1

Mine Cars and Locomotives Should Fit the Conditions They Work Under—Here's How to Select Them

By STEPHEN KRICKOVIC
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IT has been said many times that mining is essentially a materials handling operation from the time the material is broken down at the face until it is deposited as clean coal in the railroad cars. Nothing is more to the point, and main line haulage is an extremely important, if not the most important, link in the total moving chain.

What is, or should be, the function of an efficient transportation system in a coal mine? The most complete answer to that question may be stated as follows: The maintenance of flow of the required tonnage of material each shift from the producing sections to the car dumping station without delay in the operation of the mining equipment, with minimum of operating labor, maintenance and power and with safety. This, indeed, is quite an order, and should indicate that considerable study and analysis are necessary to reach the correct decision on all counts.

The easy approach is followed at times, and perhaps too often. There is an inclination to adopt what the other fellow has found to be successful in his mine without first determining whether the basic factors can be similarly evaluated. Haste to profit by the improvement is probably the strongest incentive. Unwillingness to bother with the details of a study is another. A third reason is the feeling of some that the only way to prove a point is to try the equipment, the machinery or the idea.

It appears that total or even partial solution of the many problems will be almost as varied as the basic governing conditions in the different mines. What is designed for a 2000 tpd drift mine with a 15-year life would not be entirely suitable for a 4000-tpd operation with a 40-year life. Also a thin seam mine would present a different problem than a thick seam. Again, a seam with rather sizable undulations would require special considerations as compared to one with average or flat grades. The list of basic conditions which will influence the design of a haulage system may be summarized as follows:

(1) Seam height.
(2) Reserve tonnage.
(3) Desired daily production.
(4) Number of daily shifts to be worked.
(5) General shape of the property.
(6) Seam contours.
(7) Character of roof and bottom.
(8) Average seam rejects.
(9) Daily tonnage of mine rock handled.
(10) Type of mining equipment.
(11) Mining plan and general projection.
(12) Maximum length of main line haulage.

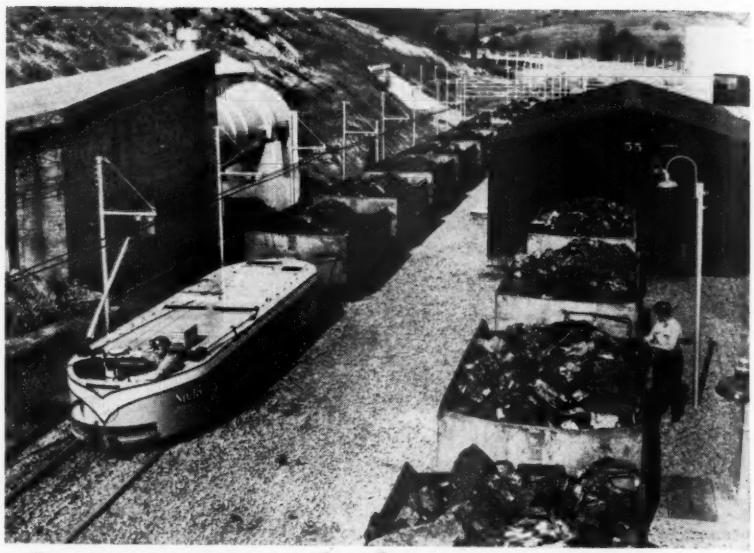
Haulage Layout

With this list as a basis, the rest of this article will present and develop the various items in the design of a main haulage system in a theoretical

coal mine "A." This mine has drift openings, and is located in a reserve of 30,000,000 tons of coal having an average seam thickness of 48 in., firm slate top and fireclay bottom. The daily two shifts' production is to be 4000 tons of clean coal, and the rejects are estimated at 25 percent. Seam grades will vary from 0.0 percent to 5.0 percent, and the general dip is an average of 1.5 percent in the direction of one group of main headings in which the maximum haulage grade against loads is also 1.5 percent.

It is assumed that conventional mobile loaders, shuttle cars and room heading belts will comprise in general the mining equipment. It is also assumed that 10 loading stations will be required for the average 3000 tons of run-of-face material and mine rock per shift, and that the average length of main line haulage for the mine is five miles one way.

First step to be taken in the determination of the haulage plan is to design the general projection of the mine and then to progress for the life of the entire property. This very important study will, in general, facilitate deciding on the order of mining in the various areas to obtain the most economical set-up during the life of the mine, considering the quality of coal, percent rejects, location and length of main line haulage and its grade. It is recognized here that several of the basic factors might change as mining progresses through the years. It is also recognized that no one can satisfactorily forecast the coal business during the mine life of 33 years, or can afford by core drilling and prospecting to secure sufficient seam data in a virgin coal area to eliminate all the risk. However, if the over-all mining plan is designed to satisfy the known and the estimated conditions and to contain sufficient flexibility for a reasonable future change in conditions, any possible loss will be held to a minimum.



Thorough engineering study to insure choice of proper size mine car will pay well over life of the mine

Selecting Mine Car Capacity

Following the establishment of the locations for the main haulways, the next order of engineering business is the selection of mine cars. Here, one must exercise care in evaluating the data available from others on similar cars and in determining the proper size and capacity of car for the particular mine. The experience of others, good or bad, with eight-wheel cars may be misleading, unless the data are supplemented with the average speed of main line haulage and with the car turnover per day. A speed of six mph and a turnover of one will not cause the same wear and tear on the trucks and wheels as a speed of 12 mph and a turnover of three. Reference here is made only to the trucks and wheels because these items are the important ones in an eight-wheel car.

As to the capacity, a 10-ton car, which is probably the most popular, may not be the most economical for Mine "A." Let's analyze the problem.

The maximum car dimensions are to be governed by the roof conditions, requiring in some areas cross headers on legs, by the width of overcasts, by the economic height of the loading station sidetrack heading, and by the minimum radius of curvature of the track. Using 11 ft as the header span between legs, 5 ft-6 in. as the vertical clearance above rail in the sidetrack, 1 ft-6 in. as the peak surcharge on the cars and 50 ft as radius of curvature, the maximum car dimensions are 7.0 ft wide by 3 ft-6 in. high by 27 ft between centers of couplers, and the capacity is 15 tons. The tare of this car is 5.25 tons. The 10-ton car will measure 7 ft wide by 3 ft-6 in. high by 20 ft between centers of couplers, and will tare 4.1 tons.

Summary of the pertinent facts about the two different car capacities are as follows:

	10 Ton	*15 Ton*
Number of cars required	325	250
Car cost—approximate	$550,000	$475,000
Size of main line trip	25 cars	20 cars
Weight of cars per trip	103 T.	105 T.
Weight of material per trip	250 T.	300 T.
Weight of main line locomotives required	34 T.	38 T.
Number of main line locomotives required	2	2
Average round trip speed	10 mph	10 mph
Power ... 6% less per ton for larger cars		

General and long-term mine projections are important factors in design of mine haulage systems

It is evident from the above tabulation that the larger car is preferable. The advantage is actually greater than indicated because car maintenance, with fewer units and lesser number of wheels, will be lower. One possible objection to the longer car may be the loading of mine rock directly with a mobile loader. This situation, however, may be remedied by partial loading of the car, or by hauling the rock in reinforced shuttle cars and loading into the large cars from a ramp.

You might wonder how a smaller four-wheel car, say a five-ton unit, would compare with the eight-wheel car in cost and performance. Briefly, to handle the 3000 tons of material per shift, 650 cars would be required, and their total capital cost would be greater by roughly $45,000 and $120,000 than the cost of the 10- and 15-ton cars, respectively.

Additionally, due to the 2.1 to 1 ratio of live to dead weight of the five-ton unit, compared to the 2.45 to 1 ratio for the 10-ton car and 2.85 to 1 for the 15-ton car, the haulage power cost would be 8 to 10 percent greater with the small four-wheel cars.

On the item of maintenance, large cars should be as good as, if not better than, the well built small ones, with the possible exception of wheel wear. However, the improvements now in progress on certain types of trucks will, it is believed, decrease the flange wear and increase the wheel life appreciably. The extent of this improvement will be governed both by the life of wheels, now considered generally acceptable on well designed smaller four-wheel cars, and on the price industry can justify paying for the eight-wheel cars. As one manufacturer put it, "we can build an eight-wheel car today that will practically double the present wheel life under the heavy load and fast speed conditions, if you are willing to pay the price."

Still in line with wheel wear is the very significant point of a balanced wheel with a tread that approaches closely a perfect circle. Certainly, wheels with irregular diameters and unequal weight distribution are totally inconsistent with fast speeds. Not only will they cause excessive wear, but can cause serious wrecks. One manufacturer has developed the improved wheel from cast iron, and a number of units are being tested today under actual operating conditions.

The present trend is to heavier, faster locomotives—and with good reason

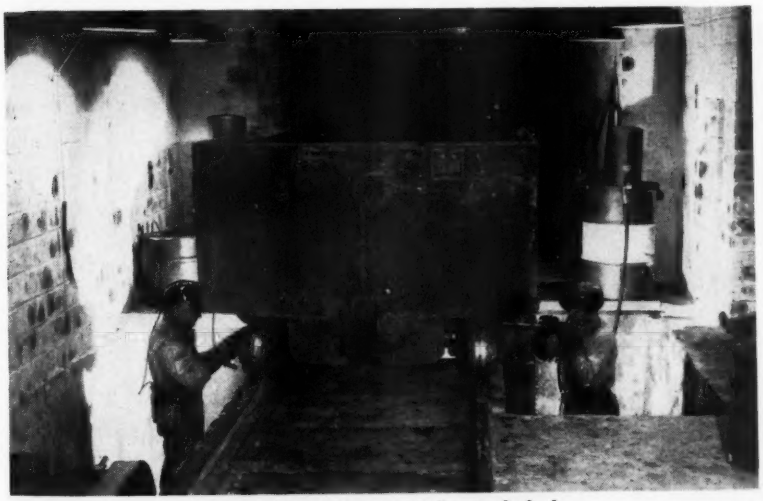
As a final note about mine cars, it is necessary to determine the maximum weight of trip that can be hauled economically up the heaviest calculated grade so that adequate draft and buff gear assemblies on all cars, as well as body and bolster king pin assemblies on eight-wheel cars, are provided at the beginning.

Type and Size of Locomotives

The next item of main line haulage design is the locomotive. Its type and size are the two major problems to resolve. In the past, and to a lesser extent today, the selection of a locomotive was governed more by the common practice in the industry than by the long-range requirements for economical operation in a particular mine. This situation was accepted and condoned probably because other major phases demanded more special attention. Today, however, the competitive struggle in the industry has focused attention on the need for transporting greater tonnages of materials from more distant producing areas at a faster speed. Let's look briefly at this new appraisal of main line haulage to appreciate its full impact on the cost of mining.

Returning to the previously described mine car analysis, assume that slow speed 20-ton main line locomotives and five-ton mine cars will be used to haul the 3000 tons of materials per shift in Mine "A." A 20-ton locomotive can haul a 30-car trip up a 1½ percent grade, and the average speed on the 10 miles round trip will approximate seven mph. Thus, five locomotives and 10 men will be required to haul the 3000 tons. This is in contrast to two locomotives (34 to 38 tons) and and four men needed to haul the same tonnage in 10- or 15-ton mine cars. In addition to the difference of $120 per shift for operating labor, the lighter locomotives will be higher in total capital expenditures by roughly $40,000 and will undoubtedly be more costly to maintain. The total advantage in Mine "A" with the heavier locomotives hauling the eight-wheel mine cars would thus be $0.08 to $0.10 per ton, compared to the 20-ton units hauling five-ton cars.

However, if the 20-ton locomotive can average nine to 10 mph on the round trip, and that is being done today under certain conditions, at least three and probably four locomotives will be needed to haul the 3000 tons of material. The advantage of the larger locomotives and mine cars would then be reduced to approximately $0.05 per ton.



Car maintenance must not be overlooked

Basic Requirements

As to the specifications for a locomotive to perform a particular duty adequately, safely and economically, the following three basic conditions must be met:

(1) The locomotive must have sufficient weight to—

a. Start and accelerate the trip to running speed without wheel slippage.
b. Haul the trip on the steepest upgrade.
c. Hold the trip on the steepest downgrade.

(2) The motors must have sufficient capacity to prevent an overload in excess of 100 percent during starting.

(3) The motors must have sufficient continuous capacity to prevent overheating. This is especially important on long hauls.

Sometimes it pays to do without intermediate haulage locomotives

Some of the other major features of a heavy duty, fast modern locomotive pertain to controls and braking. The first involves the arrangement of the control circuit so that the four motors will be connected in two groups with two motors in each group in parallel and with the groups parallel. In this dual type circuit a traction motor can be isolated, in case of failure, and power retained in the two motors on the other truck.

With respect to braking, the total function is divided into three phases—dynamic, air and hand or parking—each of which has a definite duty. There is no question about the first. Dynamic braking is desirable under certain conditions, and trips can be reduced in speed by it to roughly four mph. The problem lies with the air and hand brakes, and the manufacturers need to develop a system that will permit complete stoppage of a moving trip in an emergency, primarily when a leak develops in the main air line.

The purpose of the foregoing comments on locomotives is not to criticize the manufacturers. They've accomplished a commendable job so far, and they will develop practical solutions to the problems remaining. The main idea is that all possible chances of a serious wreck be eliminated to the fullest extent practicable.

Is Intermediate Haulage Necessary?

Before leaving the subject of locomotives, we should develop an idea about intermediate haulage. The mine car analysis for Mine "A" included four intermediate locomotives. Let's assume that these are 15-ton units, and determine the effect on the main line haulage picture if these are eliminated, as some operators claim should be done.

Using the previous data on mine cars and locomotives, the over-all time required with a large locomotive to haul 25 ten-ton car trips or 20 fifteen-ton car trips five miles to the main sidetrack in the producing area, to service each trip two to three loading stations and to haul the loaded trip five miles to the car dumping station would approximate 1.75 to two hours. This is equivalent to slightly more than an average of three trips per shift. Four large locomotives with the 10-ton cars, and possibly three with the 15-ton cars, would be needed. The cost comparison with and without intermediate haulage is as follows:

	With Intermediate Locomotives	*Without Intermediate Locomotives*
Number of large Locos. —34-ton	2	4
Number of intermediate Locos. — 15-ton	4	0
Number of haulage men	12	8
Capital expenditure for Locos.	$210,000	$225,000
Operating labor cost per shift	$240	$160
Yearly labor saving—220 work days		$17,600

These results may seem unusual and perhaps too theoretical, if it was practical to building and maintain the necessary track for the heavy equipment to the last loading point. But, since that is being done today with the use of belt haulage in the development of mains, and with commendable results, it is advisable to look long and hard at the possibility of eliminating part, or all, of the intermediate haulage. The system of mining, equipment in use and the physical conditions will, of course, have a bearing and will need evaluation. At least, the subject deserves considerable study in determining the most economic set-up.

First Heavy-Media Separation unit was installed at the Mascot Mill of American Zinc Co. of Tennessee

Heavy Density Flowsheets

Trend Is to Simplification and Use of Magnetic Media

By R. H. LOWE

Field Representative, Mineral Dressing Department, American Cyanamid Co.

SINCE the introduction and acceptance of heavy density processes as a tool of the mineral dressing industry, there have been a great number of flowsheets devised and tried in practice. Usually, these were efforts to improve upon an existing flowsheet by making minor changes, but occasionally, a complete departure was made, as will be brought out in the flowsheets described in the latter.

Heavy density, as used here, refers to processes using relatively stable suspensions of solids in water. Those using unstable suspensions with rising currents or those using true heavy liquids have not been considered. The two types of media in general use today are known as non-magnetic and magnetic. The principle non-magnetic medium is galena and the only two magnetic media in commercial use are ferrosilicon (15 percent Si) and magnetite. Other substances, such as powdered nickel have been tried, but have not found any continued commercial acceptance. The use of non-magnetic media has declined and the trend has definitely been toward the use of magnetic media.

Flowsheet of a heavy density circuit can be roughly divided into two parts, one portion shows the flow of the material being treated and the second portion the flow of the medium. Flow of the material usually consists simply of introducing the prepared feed into a separatory vessel where the separation takes place, followed by the removal of medium from the material by screening and washing. Balance of the flowsheet, which represents the major portion of a plant, deals with recovery and cleaning of medium. No attempt has been made in the illustrations to separate the flow of material and medium since the distinction is quite obvious.

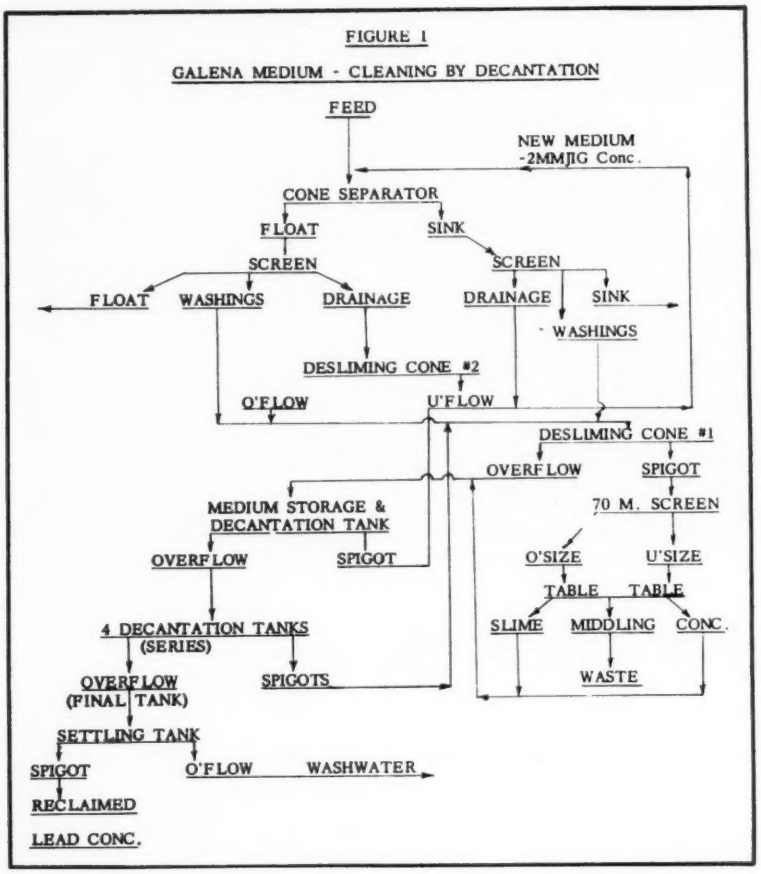
Five flowsheets are shown. The first two deal with galena medium and the next three show flows using magnetic media. As stated previously, in the case of magnetic media; either ferrosilicon or magnetite can be used and, although the choice of equipment might vary somewhat depending on the medium used, the flowsheet is basically the same so there is no need to distinguish between the two. In practice, the choice of medium is dictated by the specific gravity at which separation is desired. It is a rule of thumb that specifies magnetite for separations below about 2.40 and ferrosilicon for separations above that point. As a matter of fact, in commercial practice, a mixture of the two is often used, which permits the desired degree of fluidity and stability to be maintained while using maximum cleaning rate at all times. The fact that the two are compatible as a medium has been used by the industry to great advantage.

All of the flowsheets here described are abbreviated basic flowsheets to show the flow only and many of the details necessary for satisfactory plant operation are omitted.

With Galena As Medium

Figure No. 1 is a flowsheet showing the use of galena as a medium which is cleaned and reclaimed by decantation. This is the flowsheet of the Mascot Plant of American Zinc Co. of Tennessee, which was the first plant in the United States using sink and float methods for the treatment of ores. The galena in this plant was originally cleaned by flotation but this method was abandoned in favor of the method here shown. In common with all plants, the feed was introduced to a separator where the separation was made.

Together with some of the medium, the products were drained and washed on sceens. Here they left the plant proper to be discarded or for further treatment by other processes. The drained medium from the sink was



but, of course, the monetary return was less than this. In addition to controlling the viscosity of the medium in this plant by the elimination of colloidal material, trisodium phosphate was added as a dispersant for the slimes and was a very necessary reagent to maintain fluidity of the medium. This plant discontinued the use of galena in 1948 and since that time has operated with the standard ferrosilicon flowsheet.

Float to Clean Medium

Figure No. 2 depicts the flowsheet of a plant using galena medium, which is cleaned by flotation, and represents the original basic flowsheet of the Heavy-Media section of the Central Mill of the Eagle-Picher Co. at Cardin, Okla.

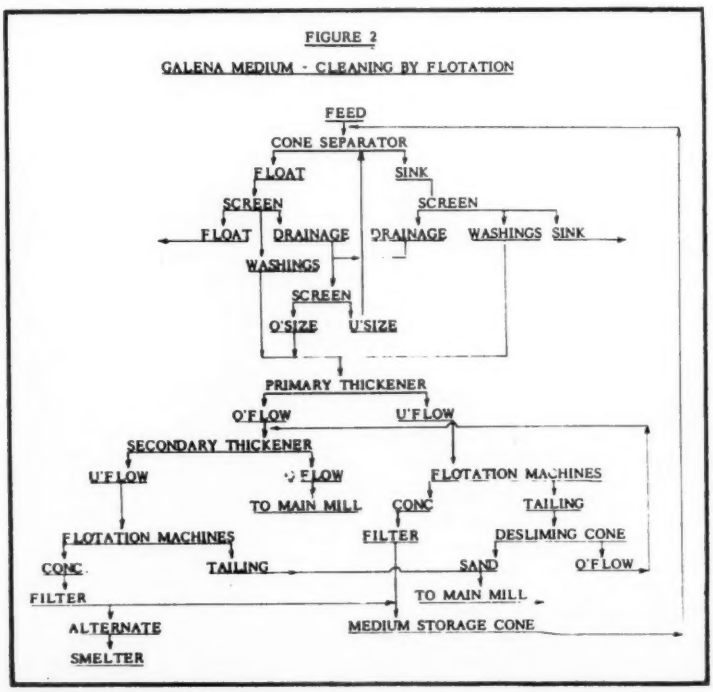
Drained medium from the sink screen and all of the drainage from the float screen, except for a relatively small cut, returns to the separator. A small amount of medium was continuously cut from the float drainage and passed over a Hummer screen to prevent a build-up of tramp oversize in the medium. Washings from both screens plus the oversize from the Hummer screen were sent to a small primary thickener, which also made a size separation. Underflow from this thickener was floated, the concentrate being filtered and sent to a medium storage cone.

Flotation tailing from this circuit was deslimed, and the sand going to the main mill circuit, and the overflow joining the original overflow from

returned to the separating cone, but the drained medium from the float side was deslimed in a separate cone, the underflow only being returned to the separator. The overflow of this desliming cone (No. 2), plus the washings from both screens joined and went through a desliming cone (No. 1) where a size separation was made. The spigot was screened at 70-mesh and both products from this screen were tabled and a sand middling discarded.

Combined concentrates and slimes from the tables were combined with the overflow of the desliming cone (No. 1) and sent a decantation tank which also served for medium storage. The spigot was returned to the separator and the overflow of this decantation tank passed through a series of decantation tanks where it was further deslimed. Spigots of all these tanks were returned to the desliming cone and the overflow of the last tank went to a settling tank for final de-watering.

Spigot of this settling tank, which was low grade lead concentrate, was sold and credited against the cost of new galena added to the plant. About one-half of the lead content of the new medium added to the plant was sold as a reclaimed lead concentrate



a primary thickener. The combined overflows were thickened and floated to produce a concentrate and a tailing. The tailing from this circuit joined the sand tailing from the coarse circuit and the concentrate, after filtering, could either be sent to a medium storage cone or to the smelter as a lead concentrate. The choice was determined by the condition of the medium in the plant.

In view of the fact that this mill was treating a lead-zinc ore, they were able to continuously replace a portion of the medium with fresh galena concentrate from the main mill flotation section. Except for this fact, it is quite unlikely that cleaning by flotation would have been economically possible because of the increasing reluctance of the galena to float as it became finer in the circuit, and also partially oxidized as a result of continuous circulation and aeration. In January 1945, the use of galena was discontinued at this plant. Since then it has operated using ferrosilicon as a medium. It is of interest to note that although ferrosilicon is being used, they retained the filters and the storage cone and both have been highly satisfactory for the purpose.

Trend To Magnetic Media

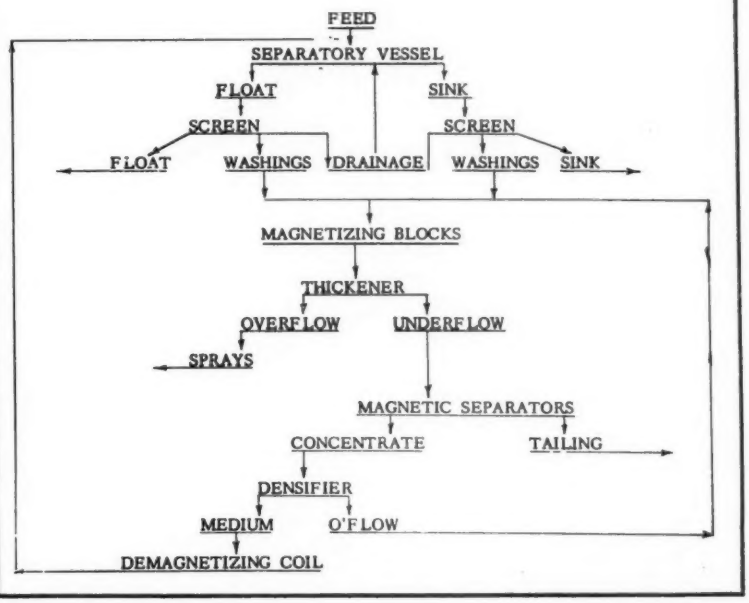
When noting that both of the plants previously described have converted from galena medium to ferrosilicon, it becomes obvious that the trend in heavy density flowsheets has been away from non-magnetic medium to magnetic medium for some time. Having seen the relative complexity of a flowsheet used to clean a medium such as galena, it can be appreciated that the principal virtue of using a magnetic medium is the ease of cleaning and the high recoveries obtained by magnetic separators. These features not only result in a simplified flowsheet and lowered cost, but also permit the treatment of dirtier ores because of the ability to clean large amounts of medium. In fact, the discovery of magnetic medium was primarily responsible for the spread of heavy density to treatment of iron ores. Prior to this time, it had been demonstrated that it was not feasible to use galena on ores containing large amounts of slime such as is normal in iron ores.

Figure 3 is the standard basic flowsheet, using either ferrosilicon or magnetite as the media, and represents the flowsheet used in the majority of the larger plants operating in the world today. The products, after being discharged from a separatory vessel, are drained and washed free of adhering medium as in the earlier flowsheets.

Drainage from both sink and float products is returned to the vessel and the washings are collected, magnetically flocculated, and then thickened. The thickener overflow, which is normally clear, is used for spray water on the washing screens, and the underflow is passed through one or more magnetic separators where the magnetic portion of the medium is recovered for re-use.

FIGURE 3

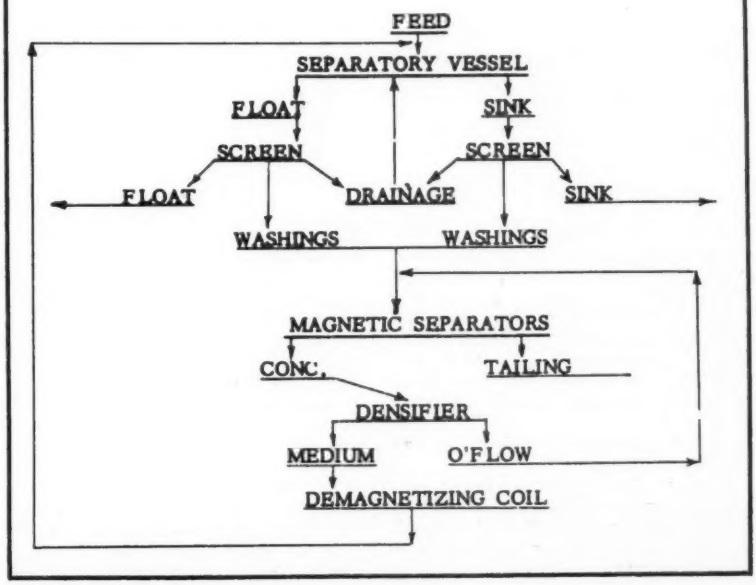
MAGNETIC MEDIUM - STANDARD BASIC FLOWSHEET



Tailing from the magnetic separators is discarded with respect to the Heavy-Media process and the magnetic concentrate is dewatered in a densifier. This is simply a spiral

FIGURE 4

MAGNETIC MEDIUM - DIRECT WASHWATER RECOVERY



classified without wearing shoes. The dewatered solids are dispersed by passing them through a demagnetizing coil and returned to the original circuit.

The "Bob-Tail" Circuit

Figure 4 represents the flowsheet used when the solids are recovered directly from the wash water without prior thickening and is commonly known as the "bob-tail" circuit. This flowsheet was originally conceived for use in the Illinois-Kentucky fluorspar district where there was use for a plant of small capacity and preferably of lower capital cost. In looking at the flowsheet, it will be noted that with the exception of the elimination of thickeners ahead of magnetic separators, it is exactly the same as the previous flowsheet. The use of this type of flowsheet has spread particularly because it is the type used by various manufacturers who produce the so-called "package" plants. More recently, there is a trend toward this type flowsheet in larger plants due primarily to improvements made in magnetic separators which permit them to take larger volumes of water than did the previous models. The advantage of this flowsheet is lower capital cost for a plant. The disadvantages are a higher medium loss in the cleaning circuit brought about by a greater volume of magnetic separator feed and the tendency to use less wash water on the screens which results in higher loss by adherence. Attempts to overcome this latter disadvantage are currently being made by counter-current washing on the screens and the introduction of pools under the sprays for more efficient washing with less water. All indications are that the trend will continue toward this type of flowsheet except for large capacity plants.

It might be pointed out that the lack of surge capacity ahead of the magnetic-separator circuit can result in operating difficulties. This is especially true when a magnetic separator or a densifier becomes temporarily overloaded, due to the build-up of a circulating load.

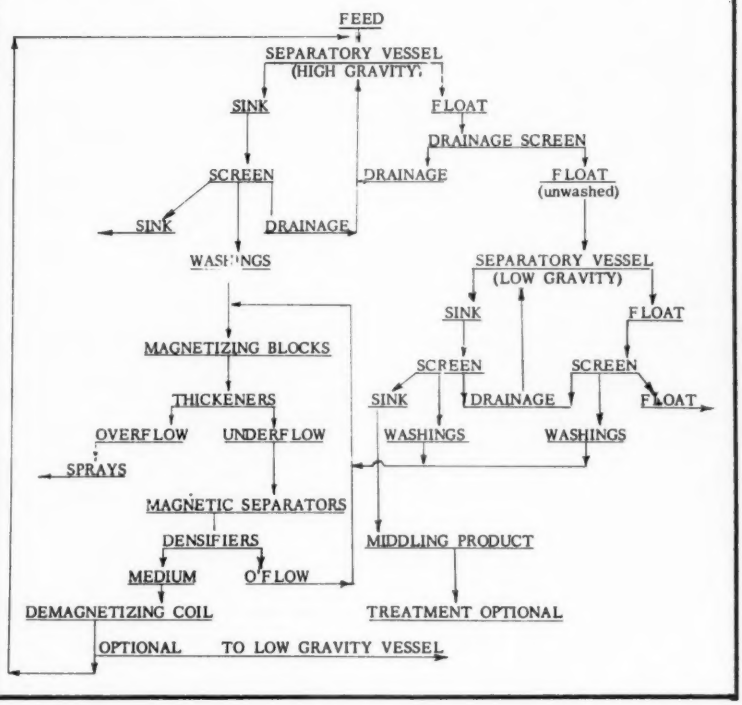
Three Product Circuit

Figure 5 represents a flowsheet using a dual gravity system with magnetic medium. Although this flowsheet could be applied to any ore where it would be desirable to produce a concentrate, middling, and tailing, its present use is confined to coal washing. The feed is first introduced to a high gravity vessel, and sink from this vessel is treated in the conventional manner by draining and washing on a screen.

Float product is drained in the conventional manner, but instead of being washed free of medium is passed, together with adhering medium, to a secondary vessel which is operating

FIGURE 5

MAGNETIC MEDIUM - DUAL GRAVITY FLOWSHEET



at a lower gravity. The sink and the float products from this vessel are treated in the usual manner, and the washings combine with the washings from the primary sink to go to a magnetic cleaning circuit. Solids from this circuit are normally returned to the primary vessel, but if necessary a portion can be by-passed to the low gravity vessel. This is seldom necessary, because a balance is usually maintained in quantity of in-coming and out-going medium.

A very interesting point in this type circuit is the means to maintain classified medium by sending only the finer fraction of the medium from the high gravity vessel to the low gravity vessel, thus making it possible to maintain fluid medium in both circuits and yet operate with one cleaning circuit. If the same medium, with regard to particle size of the solid constituent, were used in both circuits, the results would be either an unstable low gravity circuit or viscous high gravity circuit. The products from the low gravity vessel are a low gravity float, which in the case of coal is usually the finished product, and the sink, which when referring to the original feed, would be a middling, and can be handled in several different ways. In the case of coal, where the low gravity float is a metallurgical coal, the sink can be sold as steam coal; it can be crushed and recirculated; or it can be crushed and further treated in a separate plant. There is a definite trend for this type flowsheet in coal washing because of the demand for metallurgical coal from raw coals of lower quality.

Trend to Simple Flowsheets

Thus, it can be seen there is a trend toward simplification of the flowsheet, but it is rather remarkable that the basic flowsheet used today is practically the same as that first used with magnetic media. The trend toward simplification is a result of improvement in the equipment used. Although not within the scope of this paper, and not brought out by these basic flowsheets, very great strides have been made in simplifying plant design and in the manufacture of equipment for the specific purpose required. There can be no doubt but that the trend in improved design, improved equipment, and process improvements will continue, and that the use of heavy density as a unit process in beneficiation has been accepted.

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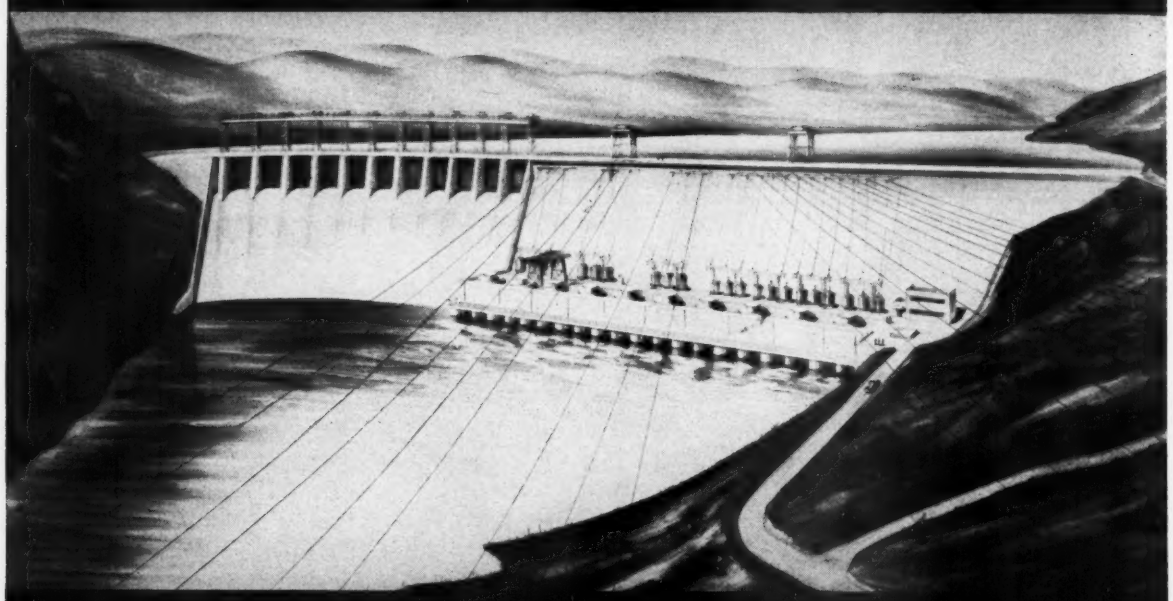

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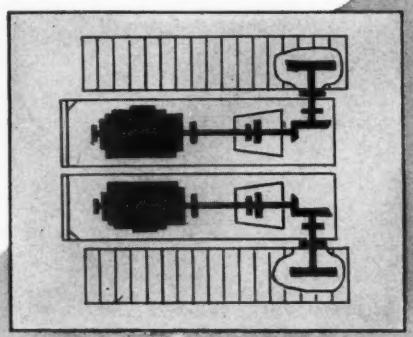

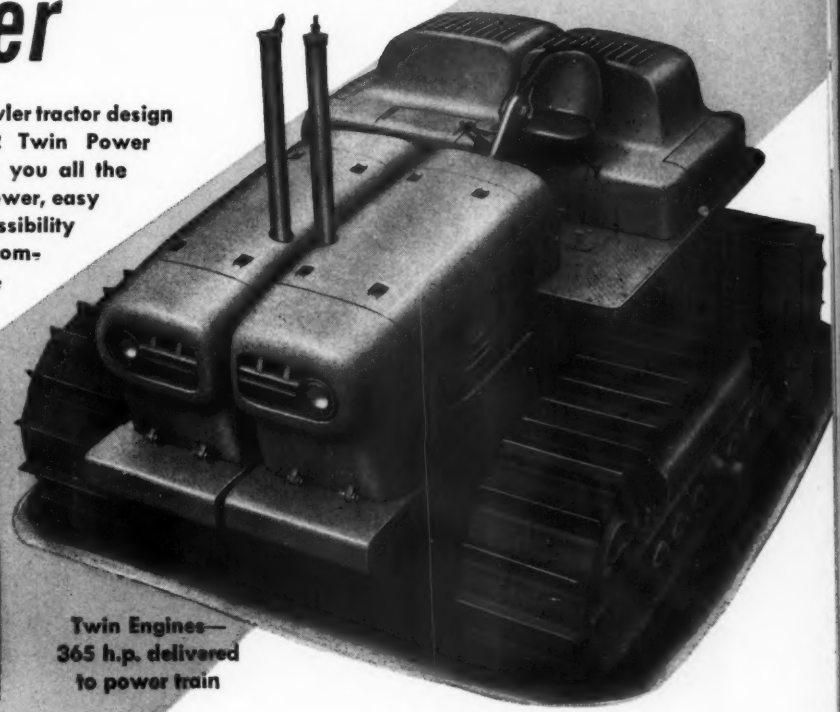

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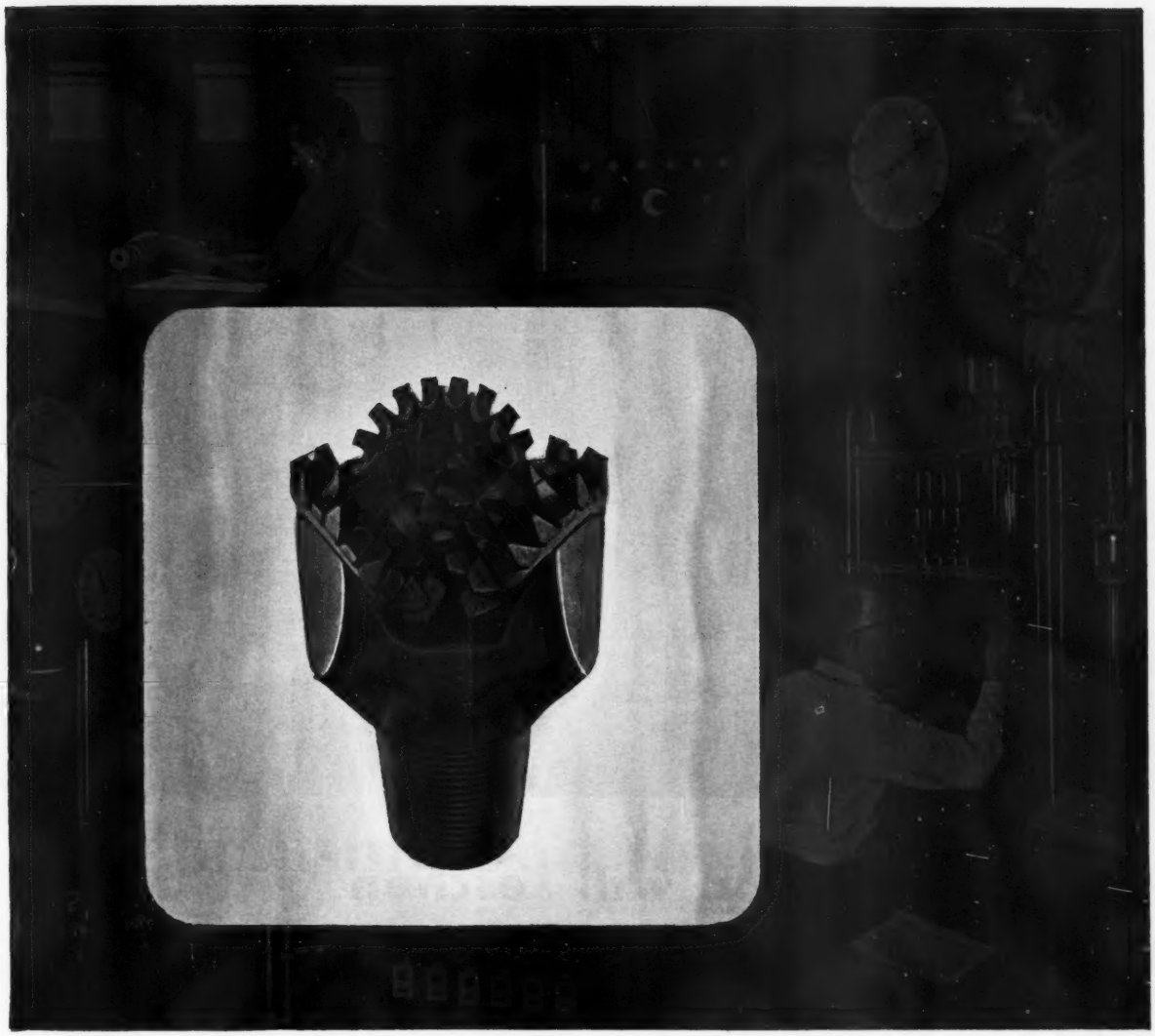

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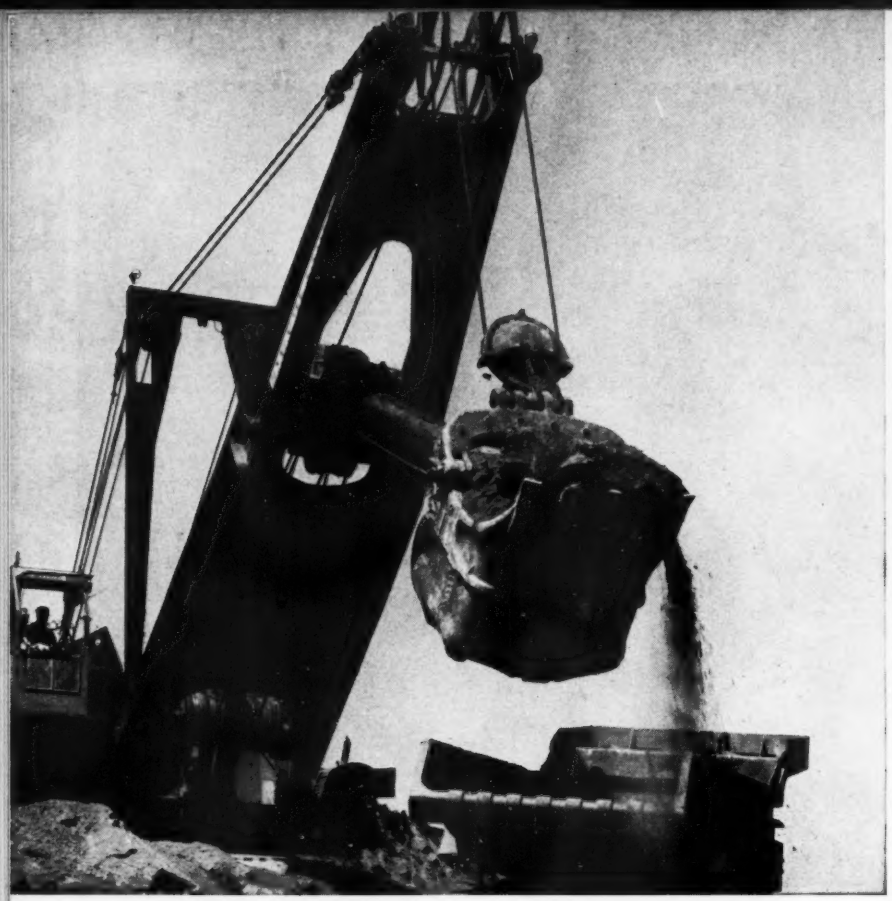

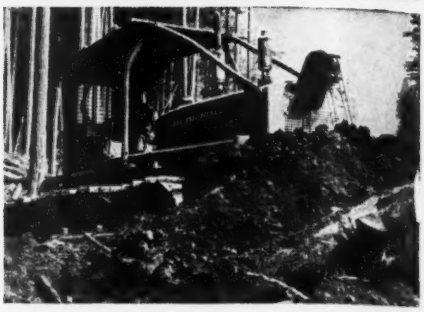

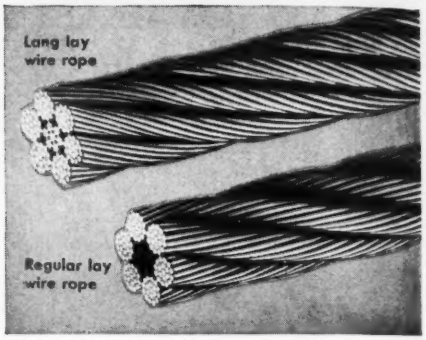

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HKP

The activities of today's section foreman are more closely tied to a mining company's profit and loss statement than ever before

An Evaluation System for Foremanship and Its Uses

Door to Added Profits Can Be Opened by Applying the Principle of "the Right Man for the Right Job"

By E. B. LEISENRING, JR.
Assistant to the President
Stonega Coke & Coal Co.

SINCE the concept of personnel evaluation is a relatively new one, and since it can take many different forms, a brief definition of evaluation for mine management personnel as it is practiced by Stonega Coke & Coal Co. is in order. Examples, to bring out the general points made here, will be given further on.

Our system uses a form sheet, drawn up from suggestions made by the men actually using the sheet. Each foreman has his strong points and his weak points evaluated on one of these sheets by each of four or five of his immediate superiors. This evaluating is done twice a year. These four or five opinion sheets are treated as confidential matter, and their contents are brought together on a "consensus" sheet.

The "consensus" sheet information is used by management to eliminate deficiencies, friction and obstacles in mine management which could be otherwise undiscovered or underestimated. The information is also used in personal interviews by a higher official of the company with each section foreman, about once a year. The results from these interviews are proving to be very gratifying.

Recognizing the increasing importance of good supervision, the leading companies in several industries have for a number of years had personnel evaluation programs under way. Companies with a reputation for the highest capability in management (E. I. du Pont de Nemours & Co. and General Electric Co., to name two) are spending tens of thousands of dollars each year in evaluation programs. Although the results of personnel programs are often impossible to measure in dollars and cents, the fact is that these programs, which were begun as experiments, are not only continuing but are expanding rapidly. This should stand as proof of their permanent value.

The Need for Personal Evaluation

To understand more fully the role played by the section foreman in the modern coal mine, let's take a look at the difference between two typical coal mines, one in 1935, one 20 years later in 1955. The typical 1935 mine produced 2000 tpd, employing 335 men, about six tons per man-day. The 1955 counterpart, also producing 2000 tons, employs 100 men, one-third as many, at 20 tons per man-day. The value of the equipment in the 1935 mine for which the foremen were responsible was approximately $296,000. Today the equipment under the foremen's eye is worth nearly $770,000. If the

mine is using continuous miners, the value of the equipment may be higher.

The conclusions to be drawn are that the section foreman produces the same amount of coal with one-third as many men but with two and one-half times the dollar value of equipment. The section foreman who 20 years ago was expected to make one or two rounds of his section as an overseer, is today required to be looking down his men's shirt collars throughout the eight-hr shift. In turn, the mine foreman must work closely with the section foremen, and the mine superintendent must keep in close touch with all supervisors under him.

The increased pressures on the present-day foreman, the additional training and knowledge required of him, and the value of the equipment for which he is now responsible create new problems which higher management must not ignore. Most mining men are familiar with the expression, "You've got to have good supervisors, because the section foreman has his hand in the company's pocket."

In setting up a system to evaluate supervisors, Stonega believes that each man should be evaluated by more than one superior, preferably by four or five. In this way each man's grade is a consensus of opinions, and personal likes and dislikes are to a great extent cancelled out. Our system now in use has each superintendent evaluated by the resident vice-president, the general manager, and the production manager. Each general mine foreman is evaluated by the above persons and by his superintendent. Each assistant mine foreman is evaluated by all the above and by his general mine foreman, or by a total of five. Each section foreman is evaluated by the superintendent, general mine foreman, and assistant mine foreman at his mine. Also evaluating each section foreman may be a general superintendent or director of safety, provided they have the opportunity to know each section foreman sufficiently well.

NAME Miner, John D. POSITION section foreman

MINE OR DEPARTMENT Crossbrook

CHOOSE AND MARK ONE BOX FOR EACH CATEGORY

RESPONSIBILITY	TRIES TO PASS THE BUCK EVERY TIME	PASSES THE BUCK SOMETIMES	WILL SHOULDER HIS SHARE	☒ ANXIOUS TO ASSUME RESPONSIBILITY
LABOR RELATIONS	SEEMS TO CLASH WITH HIS MEN	GETS ALONG WITH MEN BUT AT COMPANY'S EXPENSE	☒ GETS ALONG ALL RIGHT WITH HIS MEN	GETS THE MOST FROM HIS MEN
PLANNING	CANNOT PLAN WORK	DOES NOT PLAN WORK WELL	PLANS WORK FAIRLY WELL	☒ PLANS WELL, AND IN ADVANCE
PRODUCTION	CANNOT GET PRODUCTION	PRODUCES, BUT AT EXPENSE OF HOUSEKEEPING AND SAFETY	AVERAGE GOOD PRODUCTION	☒ HIGH PRODUCTION WITH EFFICIENCY
DELEGATING AUTHORITY	CANNOT DELEGATE	DELEGATES BUT DOES NOT FOLLOW THROUGH	DELEGATES FAIRLY WELL	☒ ALWAYS DELEGATES WORK FOR BEST EFFECT
JOB POTENTIAL	HAS GONE FARTHER THAN HE SHOULD HAVE GONE	HAS GONE AS FAR AS HE SHOULD GO	MAY GO SOME HIGHER	☒ COULD GO CONSIDERABLY HIGHER

(This form is not complete without filling out the following two statements.)

PLEASE COMPLETE:

THIS MAN'S GOOD QUALITIES WHICH BEST HELP HIM TO DO A GOOD JOB ARE: the best section foreman in this mine. Could handle a higher job, except for one problem (see below)

THE WEAK POINTS WHICH HE NEEDS MOST HELP IN IMPROVING ARE: loses patience with men who do not learn quickly. Otherwise he is well-liked by men, and I believe has the ability to overcome this quick temper.

(YOUR REPORTS AS RECEIVED WILL BE CONSIDERED CONFIDENTIAL. WHILE FILLING THEM OUT, DO NOT COMPARE NOTES WITH OTHER REPORTS BEING FILLED OUT. PLEASE KEEP PERSONAL FEELINGS FOR INDIVIDUALS OUT OF THESE REPORTS INSOFAR AS POSSIBLE.)

DATE 5/21/55

FILLED OUT BY John Doe POSITION Gen. Supt.

Each management employe is rated by four or five of his immediate superiors who use the above form

System Developed by Experience

The actual evaluation is done, by our company, twice a year, on a special form. The first form used had seven categories of job performance: progressiveness, labor relations, planning, know-how, production, associations and habits off the job, and job rating. The man evaluating was to check each category once in one of four ratings, roughly corresponding to poor, fair, good and excellent. At the bottom of the sheet was a space for remarks of a more general nature.

The fault with this form was that most men who filled it out were reluctant to commit themselves to rating others in a 1, 2, 3, 4 fashion. They felt that there were many more possibilities than appeared on the sheet. Experienced personnel experts point out that the word "rating" should be avoided, since it implies a critical inspection of the men rather than a program of participation and self-benefit. Also in our first survey probably not enough preliminary explanation and groundwork was done, since only 102 of the 321 forms filled out, or 32 percent, gave general remarks of any real value.

The heart of this business of evaluating supervisors is not how it is done, but why it is done. Evaluation is, and must be, for the benefit of those who are being evaluated. If the members of mine management get the idea that here is some kind of spy system coming in, or that it is an implied criticism which will make their jobs less pleasant and less secure, then the evaluation will do more harm than good.

Before attempting a second survey, therefore, we had two meetings at each mine. The first meeting was attended by the general manager and other department heads with the superintendent, general mine foreman, and assistant mine foreman. A thorough explanation of the purposes of the evaluation program was given. Faults found with the first survey were brought out, and by creating a discussion group with all participating, an actual enthusiasm was generated for future plans.

Here was a good opportunity to give full explanation to the fact that the completed evaluations are treated as "confidential" material. The persons filling out the forms were also given an envelope, addressed to our home office. Once received in Philadelphia, the contents of the completed forms were consolidated so that each evaluated man had a single "consensus" sheet. Copies of the completed forms were given to the resident vice-president and to the general manager. It was carefully explained that these two men were the only ones on the property to see the completed forms. This policy of partial secrecy is vital

for encouraging free expression in filling out the forms.

Suggestions from this first group of mine office meetings produced the form used in our second survey. A simpler form, it offers fewer categories on which to evaluate the man. At the same time it offers a greater opportunity for unrestricted comment and it specifically requests that such comment be given. Two statements are left to be completed: "This man's good qualities which best help him to do a good job are: . . ." and "The weak points which he needs most help in improving are: . . ." On this new form many more comments of a valuable nature are given. It is this information, used in strict confidence and only for the supervisors' benefit, which forms the keystone of the value of our system.

The second group of meetings at each mine before the second survey brought together the same persons as at the first meetings, plus all the section foremen at each mine. Since the section foremen knew about the first survey by word of mouth, the best policy was to give them the fullest explanation possible of the program and of its purposes. In other words, once having won over the superintendents, general mine foremen, and assistant mine foremen, we tackled the more difficult task of enlisting the section foremen's understanding and support of the program.

How the Information Is Used

We have found four major uses for the information gathered by our surveys:

(1) To bring out any unfavorable personality situations at the mine which may be otherwise unnoticed or underestimated. Example: Two foremen, in the same section on opposite shifts, have developed a mutual dislike. Although this has been suspected, the survey and interviews bring out its seriousness, and the men are put on different sections.

One result of the program has been to make mine management aware of the increasing importance of foremanship qualities

(2) To discover obstacles confronting the individual foreman which may be overcome by helpful advice or further training. Example: An assistant mine foreman's work is going downhill. He is having trouble at home, but pride keeps him from seeking help. By giving tactful advice, the interviewer shows him how the company can be of assistance in finding a happy solution.

(3) To bring to higher management's notice men of above-average potential who might otherwise go overlooked. Example: A section foreman of unusual potential is disliked for a personal trait by the general mine foreman, which keeps him from being advanced. The survey, however, shows a more accurate appraisal, and also discloses the general mine foreman's dislike.

(4) To make mine management, section foremen and their superiors alike, aware of the increasing importance of the qualities of foremanship. Example: A potentially fine chief electrician is doing a rather mediocre job. His attitude of "another day, another dollar" is broken by the realization that management is focusing a sharp light on his qualifications, and at the same time showing him that his good points, with proper effort, can earn recognition and even promotion.

These four uses demonstrate the fact that the basic goal of evaluation must be as a benefit to those being evaluated. It is difficult to emphasize strongly enough the fact that without a true spirit of participation and understanding of the goal of self-benefit, no such system will be a success.

A most significant development of the second use mentioned—helping the foreman to overcome individual obstacles—is the scheduling of personal interviews. In our case, the general manager is the interviewer. The interviewer must have a certain amount of talent for interviewing men, which can be developed further with practice. He will call in each section foreman, of which we have approximately 80, for an interview about once a year. He may interview less often those men who need the least help. The interviewer may or may not show the foreman his "consensus" sheet, depending on its contents. He will comment favorably on the foreman's strong points first, and then help him "talk out" his areas of difficulty. It will afford the interviewer a valuable chance to know individual foremen better. At the same time, the interviewer has a chance to discuss the evaluation system in general, and to do a further job of "selling" the foreman on its value to him.

An orientation meeting was held to acquaint all concerned with the facts of the evaluation program

Program Considered Successful

After several surveys and series of interviews have been completed, and the program has won a certain amount of approval from those participating in it, a number of additional features may be explored. Each foreman may be asked to fill out a form evaluating his own job qualities. This can pro-

(Continued on page 86)

Education and training in general safety and self-preservation can be most effective

Mine Safety

Every Mine Fire or Explosion Can Be Prevented or Controlled

By JOHN J. REED
Mining Engineer
Berkeley, California

THERE are two sides to the question of who is responsible for mine safety. Labor says it is management's responsibility to provide safe equipment and working conditions, while management may say that it is up to the worker to follow the rules, work safely, and not get himself hurt. Both sides are partly right, but management is in position to control working conditions, and therefor is the more responsible. It is labor's part to cooperate by observing safety rules and to work as safely as possible with the equipment provided and under existing conditions.

Safety education, initiated by management, may help the labor force to cooperate intelligently. This is especially true when dealing with native labor, perhaps largely illiterate and completely unaccustomed to mechanical equipment. It is up to management to choose the safest methods and procedures which are to be used, and to provide the safest equipment to accomplish the job.

Just as it is the obligation of any boss to look out for the safety and welfare of his men, it is the moral obligation and responsibility of management to protect the labor force from unforeseen dangers. This is especially true as regards the possibilities of major disasters involving the entire mine or operation.

The average workman cannot be expected to concern himself with conditions beyond the limited radius of his own working place. He rightly expects management to protect him from dangers threatening from outside his working radius.

Management cannot be expected to foresee unpredictable acts of God, but there is no excuse for failure to observe the basic fundamentals of mine safety recognized as principles for generations, or for a failure to profit from the experience of past mine disasters.

Ventilation Control First

Maintenance of positive control of mine ventilation is usually important during normal operation to increase efficiency and provide healthful conditions underground. During fires or after explosions, such control may provide the only means of saving the men, controlling the spread of flames, or preventing further explosions.

Natural ventilation may be quite regular and dependable under normal conditions, but let a fire start underground and no one can predict what may happen to the air currents. Furthermore, if no provision has been made to make the ventilation positive, either by doors or fans, there will be no way to gain control and force the air flow back into the established pattern.

The importance of *accurate* knowledge of the mine air currents cannot be over-emphasized. It is not sufficient to *assume* the air will flow in what seems to be a logical direction. Careful surveys should be made to trace the complete circuit of the air through the mine. All air in the various splits should be accounted for so that unusual losses or short circuits will be revealed. During a fire, gas and smoke may short circuit through an old open stope, forgotten raise, or abandoned cross-cut, and block an avenue of escape thought to be safe. All possible

combinations of fans running normally, reversed, and shut-down should be tested with doors open and closed. Only with the results of such tests is the mine management prepared to make accurate estimates of how best to evacuate the mine and control the ventilation.

None Immune

The metal miner is prone to consider himself relatively safe from mine fires and explosions, and to think of the coal miner as the man especially subject to such disasters. This may lead to dangerous complacency in metal mines, and neglect of basic principles of mine safety. Serious fires and explosions have occurred in metal mines all over the world, and *no* underground mine can be considered immune.

All combustion products of an underground fire are confined, and only a limited supply of oxygen is available. Fire therefore rapidly depletes the critical supply of life supporting oxygen, and at the same time produces large amounts of deadly carbon monoxide because of the incomplete combustion. For these reasons, the gases and smoke from mine fires are far more dangerous to the men underground than the fire itself. This explains the importance of an accurate knowledge and positive control of mine ventilation. The amount of combustible material may be exceedingly small and the fire itself completely local; yet the smoke and gas generated may kill hundreds of men.

Types of Fires

Although fires often start in the places considered least susceptible, a few especially dangerous spots might be listed as worthy of particular attention. Timber is the obvious danger in mines requiring close heavy support. This is especially true in the shafts and main entries which are usually the main airways as well. A fire in such a location spreads rapidly because of the high air velocity, and the smoke and gas are carried quickly into the working places where the men may be overcome before they can escape. It is especially desirable therefore that such critical openings be supported with fireproof materials such as concrete and steel. In answer to protests against the elimination of timber for underground support, the asbestos mines are cited. In them even the use of matches is discouraged underground because the wood fiber will contaminate the ore. Surely if the asbestos mines can eliminate timber entirely because of economic necessity, other mines can do so in a few critical openings for the sake of mine safety.

Shops, forges, oil storage rooms, powder magazines, and similar installations are particular fire hazards when located underground or near

Multiple mine doors are best insurance against spread of explosion or fire

portals or shaft collars. If placed underground, they should be of completely fireproof construction. Such installations should never be located in a through airway or travelway, or in any opening which might conceivably *become* a through airway due to unforeseen changes in ventilation or failure of doors or bulkheads due to fire, explosion, or cave-in. They should be well offset from such through ways and thoroughly isolated by *multiple* fireproof doors.

The disposal of combustible refuse underground may produce an especially subtle fire hazard. Empty dynamite boxes, wrappings, crushed, decayed, and scrap timber from repairs, etc., is often disposed of by dumping into old workings and stopes. Accumulations of such material are very susceptible to fires by spontaneous combustion. Combustible waste should be removed from the mine if possible, and may even be useful as fuel outside. If dumped into old workings underground, it should be done only in conjunction with active filling with waste rock so as to thoroughly dilute and isolate the combustibles. Care must be taken to suspend combustible dumping as soon as waste filling slows or is suspended; otherwise large accumulations of combustibles may occur all unsuspected by the disposal crew.

Spontaneous fires may occur in massive sulfides, coal beds, and in the gob or crushed fill material consisting of waste rock, sulfides, coal, and timber. Such fires usually start slowly in isolated sections and are difficult to control. Such a fire necessitates expensive precautions to safeguard the ventilation of the rest of the mine, and may ultimately cause the abandonment of the workings.

Types of Explosions

Although methane is commonly found in coal mines, it may also occur in sedimentary rocks in the absence of coal. In the California Coast Ranges, serious methane explosions have occurred in metal mines and tunnels.

Suspensions of finely divided dust of certain materials can be very explosive. Coal, sulfide, and grain dust are examples. Where appreciable amounts of coal or sulfide dust occur, a blast or other air disturbance may stir up enough dust to form an explosive mixture. Once ignited, such an explosion will propagate itself. This is often the explanation of disastrous coal mine explosions where only small local concentrations of methane occur. Occasionally when mining massive sulfides, an unusually strong blast is experienced upon detonating the stand-

Every crew going underground should include more than one man familiar with the entire mine

ard round and charge. This is due to the ignition of the sulfide dust suspension formed by the first shots of the round.

Gaseous products of a mine fire may in themselves be explosive. Carbon monoxide, oil fumes, and other gases and vapors generated by confined fires may accumulate in the workings and finally explode; hence the importance of protection against both fires and explosions in *any* mine.

Plan Evacuation

When confronted with danger underground, it is the natural tendency of any miner to try to go out by the route to which he is accustomed. All too often that is the route first rendered impassable. For this reason, it is of primary importance to provide and *mark plainly* alternate escape routes from all working places. The larger and more complicated the mine, the more important this rule. If small numbers of men *must* work in isolated sections with but one exit, then they should be provided a refuge where they can safely wait until rescued.

In a large mine employing many hundreds of men, it might be economically impossible to train all the men to know the whole mine. However, the key personnel, down to the bosses in direct charge of the men, usually amount to not over 5 or 10 percent of the total underground force. These men can easily be trained to know the whole mine, and the relation of their own section to all the other sections. Not only will this knowledge enable them to lead their men to safety in time of danger, it will also help them to do their job better from day to day.

Need Warning Signals

Even in the more systematic mining methods the men are scattered in small groups. The problem of warning them of impending danger is one of the most important and difficult factors in mine safety. Five minutes' delay may mean the difference between life and death to the man underground.

In mines with an extensive compressed air system, a stench injected into the lines at the compressors is probably the most efficient warning. Even in the largest mines, such a signal reaches the most remote sections within 10 or 15 minutes. The stench most commonly used is ethyl mercaptan. It is harmless but quite disagreeable, and most important, it cannot be confused with any other odor.

A complete telephone system provides another means of quickly warning underground crews of danger. It gives the advantage of being able to advise the nature and location of the danger so that the best course of action may be chosen. Alternate lines should be run where possible through different entries in case one line should be damaged.

In mines having extensive electric lighting circuits, a light flashing device may be used effectively to flash a warning. One large mine has developed an automatic device for this purpose. It flashes the lights throughout the mine, first giving the international fire signal of nine flashes in groups of three, followed by the level signal corresponding to the hoistman's level signal, to indicate the location of the fire.

Fire Drills Important

In any time of sudden danger, it is a great help to the individuals involved to have previously considered their best plan of action in the face of given conditions. This is nowhere truer than in the case of a mine disaster. Rapid, *correct* decisions must be made and orders given. There is no time to ponder and calculate, as every minute is critical to those underground. The wrong decision may needlessly cost hundreds of lives. Obviously, the decisions and orders should be based on an *accurate* knowledge of conditions and how certain actions such as closing doors, changing fans, etc., will change those conditions. The only way such knowledge can be obtained is by the previous study of hypothetical disaster conditions. In this way the best possible disaster orders can be determined, before an emergency, to meet a given danger from any given locality of the mine. Of course an actual disaster will seldom exactly duplicate the hypothetical, but with minor modifications the steps to be taken will be nearly the same, and in the face of an actual emergency we need worry only about a few modifications to a predetermined basic plan.

At periodic intervals, the entire mine should be evacuated by the entire normal shift under a varied hypothetical disaster condition. Such a drill will enable every last man to become familiar with the warning systems and exits, and his duties in case of disaster. An evacuation drill should be announced beforehand, although the exact time may remain a surprise. No attempt at extreme realism (smoke bombs, etc.) should be employed, as panic and serious accidents may result. The frequency of evacuation drills will depend somewhat on the rapidity of labor turnover. One to three drills per year might be indicated.

At intervals entire mine should be evacuated under varied hypothetical disaster conditions

Provide Multiple Doors

If there is any one single factor which will save lives and prevent the rapid spread of fire, smoke, and gas in a mine, it is the provision of multiple doors at short intervals throughout the mine. Even with materials at hand, a bulkhead takes time to build; it requires neither time nor effort to close a door. Even though the doors be neither fireproof nor perfect, if enough of them are closed soon enough, air flow will be reduced to a negligible amount.

Doors at critical points, such as those isolating shafts and main sections of the mine, should be well made of steel and concrete. This is also true of doors isolating important or potentially dangerous underground installations such as hoist rooms, compressor and pump stations, powerhouses, tool and supply rooms, and electrical substations. These places can often double as refuges when properly constructed.

It is important to have multiple doors, especially at critical points, for two reasons. First, an explosion can easily destroy a strong single door, but is much less likely to destroy a second or third door. Second, if duplicate doors remain open during normal

All possible combinations of fans and doors should be tested

operation, they will be undamaged and can be closed after an explosion.

Importance of a short interval between doors in any stretch of workings should be emphasized. Often the first warning a miner receives is the arrival of smoke coming down wind from the fire. If the nearest door is too far away, and especially if up wind from him, the man may be overcome before he can reach the door. However, if he can retreat down wind, shutting doors behind him as he goes, he can probably either make a safe exit from the mine or effectively bulkhead himself in a dead end and await rescue. Multiple doors being shut by the men underground will not only help them to save themselves from the smoke and gases, it will also throttle the fire and help to control it.

Refuge Design

In some mines, especially very large or deep ones, there will be isolated sections from which it would be impossible for men to escape in case of fire. Such a situation should not be tolerated where a large number of men is involved, but when only a few men work in these sections it may be economically prohibitive to provide a second exit.

In this latter case, a properly constructed refuge should be built in the isolated section, and stocked with water, food, and emergency equipment. Compressed air should be piped into the chamber if available to supply fresh air and provide positive pressure inside. Because the maintenance of the compressed air supply is of such value to trapped men, it is important to connect all air lines in loops and supply air by multiple routes when possible so that the pressure can be maintained by an alternate route in case one line is broken.

If no compressed air is available, or the supply is not considered dependable in an emergency, then the refuge should be large enough so that the volume of air enclosed will support the required number of men a reasonable length of time. A man at rest needs about 0.9 cu ft of oxygen per hour, and the air he breathes must contain an absolute minimum of 10 percent oxygen as compared to the normal of 21 percent. For 24 hours then, he needs 22 cu ft of oxygen above the minimum of 10 percent. Now 200 cu ft of normal air contain 42 cu ft of oxygen, or 22 cu ft above the 10 percent. Therefore, in designing a completely isolated refuge, its volume should be such that there will be 200 cu ft of air per man per day that its protection may be needed. This is an absolute minimum, and allows no factor of safety. Men in a 10 percent oxygen atmosphere would almost certainly be unconscious and near death, and no carbide lamp would burn. It would be much safer to allow a volume of 300 cu ft per man per day. This would leave an atmosphere containing about 13.5 percent oxygen wherein a carbide lamp would burn and a man remain conscious. The U. S. Bureau of Mines recommends 650 cu ft per man per day to allow an ample factor of safety.

It is important that the miners be instructed as to how they can best utilize all the air entrapped. The air should be mixed occasionally, a minimum of lights left burning, and the men evenly distributed in the refuge and resting as much as possible. Carbon dioxide from the breath will stratify readily in still air, and may accumulate along the floor. Therefore, the men should be up on timber piles or sitting up against the walls rather than lying on the floor.

Some large mines, notably the Frood in Canada, let the refuges serve as regular lunchrooms, thereby making them serve a double purpose and familiarizing the men with their locations.

Stores of Apparatus

Time is the item in shortest supply during the outbreak of a mine fire. A cool headed experienced man can usually save himself if he has the necessary materials or equipment immediately at hand. Otherwise he may be overcome before he can find or gather them. As escape from the mine is the best protection of all, self rescue apparatus should be provided in many more mines than it is at present. Because of their low cost, these units can be purchased by the miner himself, if not provided by the management; and he could not buy a cheaper, more effective form of insurance. A few sets of oxygen breathing apparatus should be stored at convenient locations underground, perhaps in the refuges, for use in rescuing men quickly from locally bad air or dangerous positions which may be rapidly growing worse. In the past, consider-

Positive ventilation control saves lives, prevents fire from spreading

able emphasis has been placed on the need for stores of bulkhead materials to be kept underground so that trapped men can use them to barricade themselves. The same effort and expense used to supply multiple doors and a few refuges would offer much more effective protection to the men.

Education and Training

Education and training in general safety and self-preservation can be most effective in decreasing both minor daily accidents and the toll of a major disaster. An intelligent, trained man is more likely to be successful when facing an emergency alone than is an unthinking man blindly trying to follow some boss' rules or instructions. In evacuating a mine, the men should be instructed never to delay their exit, nor to return for tools, clothing, etc. Five minutes' delay during the early stages of a fire may mean the difference between reaching safety and being trapped.

The men underground are usually closer to the source of the trouble when a fire starts, and better prepared to take effective action, than anyone outside. Therefore they should be provided the training and the physical means (doors) to meet the situation locally, and thereby not only save themselves but isolate the fire in its earliest stage.

Safety Means Savings

A few backward organizations actually have to be sold on the value of mine safety. Naturally, the most convincing argument in such cases is a discussion of the direct economies involved.

Most direct of all accident costs is the cost of compensation for death or injury. The load of compensation payments may be deferred in the case of long-term ailments such as silicosis, but in a mine with a long life the eventual drain may become very considerable unless preventive measures are taken early in the game.

Lost time is an important direct cost of accidents. This refers not only to the time lost by the injured person alone, but also to the time lost by all concerned in the rescue, treatment, and removal of the injured and the investigation of the accident by the supervisory staff.

The training and use of replacements for the absent workers is not only costly, but inefficient service must be expected of the newly trained men for some time.

Damage to material and equipment due to accidents is certainly a direct expense.

In addition to the direct costs of accidents, there are several important effects due to the human element. Their costs, although indirect, may be far more damaging than commonly supposed.

Morale of the workers must be considered. Men will not work willingly under dangerous conditions. Even if they do not recognize dangerous conditions when they first enter the mine, it will not require many accidents around them before they see the light. If their safety and welfare mean little to their boss, they will soon learn to distrust that boss' orders.

Labor and public relations suffer in the face of a bad accident record. Unions may make exaggerated demands because of certain accidents. A bad accident record will develop distrust of the mine in the surrounding community.

The human suffering and grief to the injured and his family must never be forgotten, even though it cannot be measured in dollars and cents.

Keep Track of Uranium Production and Reserves

(Continued from page 38)

grade of 0.10 percent U_3O_8. This particular grade is used because it coincides with the minimum for which uranium ore settlements are made under A.E.C. Domestic Uranium Program Circular 5, Revised.

This cutoff is generally satisfactory for purposes of reserve calculation for deposits with average thickness in excess of 2.0 ft and average grade in excess of 0.20 percent U_3O_8. With greater thicknesses and higher grades of ore, there is less dilution in mining. If this dilution does not lower the grade of ore below 0.20 percent U_3O_8, the maximum base price scheduled in Circular 5, Revised, prevails. This price is $3.50 per lb of contained U_3O_8. Below 0.20 percent U_3O_8 the base price decreases $0.20 per hundredth percent U_3O_8 to a minimum price of $1.50 per pound at 0.10 percent U_3O_8.

In Figure 7, the dilution of an ore body with average thickness of 2.2 ft is estimated to be 92 percent at an intermediate stage of mining before exhaustion of the deposit.

Deposits less than 2.0 ft thick with average grade less than 0.20 percent U_3O_8 generally cannot be mined by subsurface methods to the extent that the full tonnage and grade of ore calculated with minimum thickness-grade of 0.10 ft-percent will actually be realized. Accordingly, such deposits are recalculated by restricting the inclusion of overlying or underlying sample thicknesses having a minimum grade of 0.10 percent U_3O_8 so that the composite thickness-grade for each sampling site does not fall below 0.20 ft-percent.

The tonnage of ore and pounds of contained U_3O_8 estimated to be present in a deposit as calculated with a minimum thickness-grade cutoff of 0.20 ft-percent is classified as *Available* in the table of mining and metallurgical availability and highway accessibility. The difference between the tonnage of ore and pounds of contained U_3O_8 as calculated with a minimum thickness-grade cutoff of 0.10 ft-percent and the tonnage and pounds calculated with minimum of 0.20 ft-percent is classified as *Not Available*.

In this manner ore reserves which are mill feed, tributary to the various uranium concentrating plants, can be segregated from the non-commercial reserves which are also included in the broad picture of A.E.C. exploration.

Several factors are used in converting volume to tonnage. For uranium deposits in sandstone, the figure of 14 cu ft per ton is widely used. For deposits in the Todilto limestone, the factor is 12 cu ft per ton. For uraniferous lignites, the estimate currently in use is 30 cu ft per dry ton.

Conclusion

The Accounting and Ore Reserves Branches of the Grand Junction Operations Office have collaborated in the compilation, classification, and calculation of uranium ore production and reserves. The joint purpose has been to facilitate the plans of the Raw Materials Division of the Atomic Energy Commission with prompt, current, systematized summaries of anticipated future ore discoveries and presently developed ores together with the flow of these ores through stockpiles to the milling plants. This program has called for the collection and organization of many thousands of items of information from the many hundreds of widely scattered uranium mines and prospects of the Colorado Plateau and other rapidly expanding areas of the western United States. The organization of these myriad items has been truly expedited by the use of punch card tabulating equipment.

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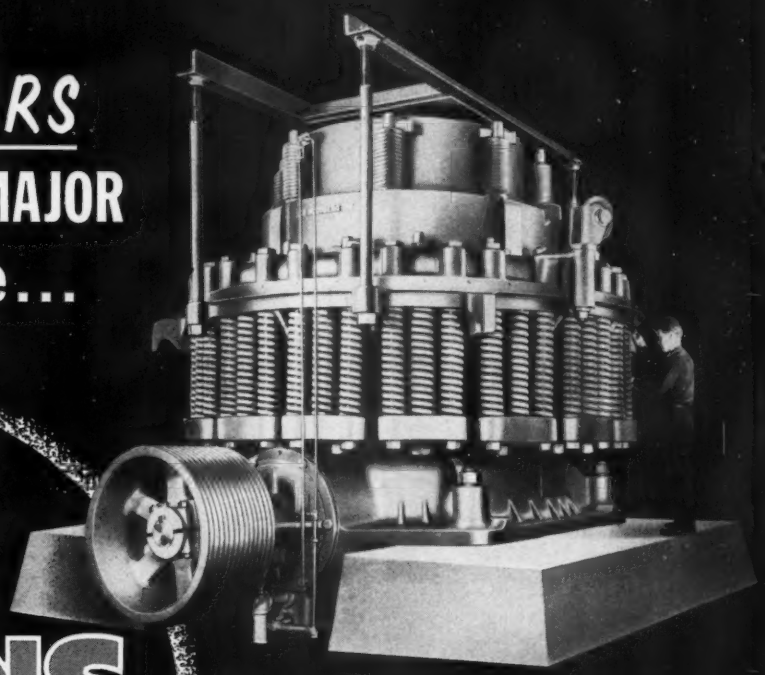

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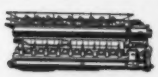


DIESEL ENGINES

Even a fire-resistant belt is no protection against accumulations of combustible material

Fire-Resistant Conveyor Belting

A Report of the Conveyor Committee Outlining Progress in the Development of Fire-Resistant Belting for Underground Conveyors

Compiled by J. L. THORNTON
Subcommittee Chairman

THE subject of fire-resistant belting continues to receive more and more attention as the use of belt conveyors underground continues to increase. The agitation for fire-resistant belting was accelerated after the loss of three lives in England at the Chatterley-Whitfield Colliery in December 1948, and at the Creswell Colliery in September 1950, where the death toll was 80. A report on these disasters was released by the Scientific Department of the National Coal Board in England on June 6, 1951.

In addition to the detailed description of the disasters, the report includes recommendations for installation and operation of rubber belt conveyors. Analyses of mine fires and methods for determining fire-resistant qualities of belting were also discussed. With no means of compounding natural rubber for adequate fire resisting qualities, and with no fire-resistant synthetic polymer (Neoprene) being produced in England, polyvinyl chloride compounds were recommended and specified for conveyor belt fabric impregnation and covers. Papers have been published which include all the data mentioned here and have been made available at AMC Coal Conventions, Mining Institutes, and AIME meetings.

Actually, there is no such thing as "fireproof" rubber conveyor belting now known and the term has been used loosely. While the coal industry might realize this, the general public takes the expression literally. Any acceptable definition, therefore must convey the idea of the degree of resisting fire. It is necessary to educate the public regarding this feature. The degrees of fire resistance, in decreasing order, according to Webster are designated by fire-resistive, fire-retardant and flameproof.

Report of the British National Coal Board

It is appropriate that a quotation be included here, from a later report, "Accident at Creswell Colliery, Derbyshire" released in June 1952 as the conditions are similar in some respects to accidents which have occurred in the United States since that time. The necessity for "good housekeeping" and the urgent need for manual and automatic safety controls is emphasized. Some slight changes are required when these suggestions are applied in the United States, but the principles generally are the same. The section from the reference report follows:

CONCLUSIONS AND RECOMMENDATIONS

"Following the failure to effect timely repairs to the badly damaged conveyor belt which resulted in torn

strips of belting collecting in the No. 2 transfer chute, the disaster was due to four successive causes: (1) a rapidly starting and growing fire spreading in the main-intake airway; (2) the failure of the fire-fighting arrangements; (3) some delay in warning the men inbye; and (4) the main return was the only means of escape for the men on the inbye side of the fire. Unless fires on conveyor roads could be wholly prevented—and it is not possible to be sure of this—then there is potential hazard from them and it is necessary to consider how best this hazard can be mitigated by action under these four heads. There is little doubt that present practice in many mines leaves much to be desired and that it can and should be improved."

The report then recommends in detail a list of the more important fire prevention measures to which the attention of colliery managements are directed. These are summarized as follows:

The conveyor way should have ample clearance above and on both sides of the belt so that any material falling off would not be in contact with the moving parts. Fireproof construction should be used for the conveyor structure and the roadway should be kept free from combustible material. Automatic safety devices should be installed to prevent overloading, belt slip and piling up coal at transfer points. There should be effective means of stopping the conveyor at any place along the roadway. The belt line should be patrolled while in operation and any damage reported immediately.

Fire extinguishing equipment should be located at critical points and the conveyor personnel should be trained and instructed in fire fighting. In case of fire there should be an alarm signal which could be heard by the men threatened by any danger. Escapeways should be maintained for all belt sections and improved forms of self rescuing apparatus should be provided.

In conclusion, the report stresses that, "even though it might not be fully effective in all circumstances—there is much that could be done which would succeed in slowing down the initiation, growth and spread of a fire, and so reduce the potential hazard to men inbye, that loss of life would be unlikely. A high degree of resistance to fire would gain very valuable time. There is, however, no short cut to success and what this disaster suggests is the urgent need for tightening up safeguards and precautions against fires at all stages. An over-riding condition of success in dealing with fires is the high calibre, thorough organization and full training of the personnel."

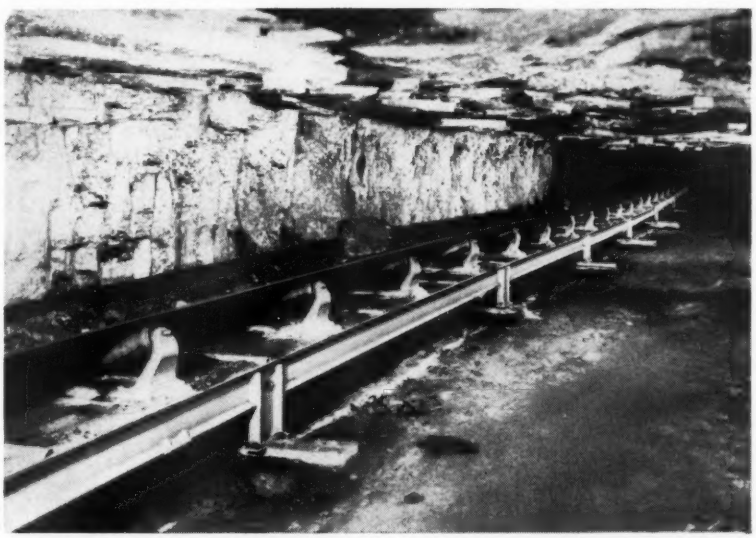
* * *

The subcommittee wishes to summarize the foregoing recommendations by repeating the following features: (1) Good housekeeping; (2) Automatic safety devices; (3) Suitable fire fighting equipment; and (4) Means of escape.

Recommendations for safety devices are included in the NEMA Standard MB 1954 in Part 2 General Standards MB 1-2.10.

The state laws in the largest producing areas in the United States publish regulations covering means of escape and in most instances much better escape conditions have existed in our mines for several years than exist in England.

Good housekeeping cannot be overemphasized. It takes no special skill or knowledge to keep belt headings cleaned up and is the cheapest method of fire prevention available to the industry.



Good housekeeping will always be one of the main requirements in operating conveyors safely

Origin of Conveyor Fires

Conveyor fires can be classified into three groups based on origin.

(1) Fires generated within the belt. This type is caused principally by friction such as would occur when a belt is stalled and the drive pulley continues to operate. The hazard of fire originating in the duck after the covers have been stripped off can be reduced by impregnating with fire-resistant compounds or otherwise treating the duck.

(2) Fires starting in other parts of conveyor system. Such fires usually start on the return rollers and idlers. The fires are due to metal parts rotating against obstructions and broken or damaged bearings. The heat generated ignites coal dust or other inflammable materials adjacent to the conveyor. There have been cases where the fire was started during an operating shift but did not reach dangerous proportions until an idle period.

(3) Fires originating outside the conveyor system. Numerous familiar sources for this type are so well known that no further comment or explanation is deemed necessary here. It should be mentioned again though, that "good housekeeping" is as essential as the use of fire-resistant belting.

Although most mine fires in the United States where conveyor belting is involved have originated in outside sources such as power cables, lubricants, coal dust, waste accumulations and oil spillage, it is certainly a step in the proper direction to develop satisfactory fire-resistant belting. It is well known that the present price of fire-resistant compounds is substantially higher than that of compounds not having fire-resistant qualities. Universal use of fire-resistant belting is retarded presently for that reason. But in any case, fire-resistant belting for installations underground will not be a panacea because of the "outside sources" listed above. Cleanliness of any conveyor system will contribute substantially to the elimination of the fire hazard. The rubber belting manufacturers, though, are accelerating their work to develop a satisfactory fire-resistant product.

Proposed Specifications

It has been apparent to this point that the designation "fire-resistant" has been used consistently in describing the quality of rubber compounds to withstand high temperatures. This is in accordance with the accepted

nomenclature established by RMA and the National Coal Association, except that "retardant" is used instead of "resistant."

It might be interjected here that there are certain fundamental requirements of a conveyor belt carcass to do the job properly. There must be enough body in the fabric and proper number of plies to support the specified load without excessive sag. Although sag is a function of belt tension and idler spacing that feature must receive consideration. There must be enough strength in the carcass to prevent over-stressing during normal operation. In addition, there must be enough strength in the carcass to absorb surges in excess of the average load. It is beyond the scope of this paper to outline in detail each rubber manufacturer's exact specification for his particular belting. Suffice it to note here that there should be a certain relation between fill threads and warp threads of carcass construction to produce a balanced product.

Certain general features in regard to manufacturing fire-resistant belting probably will include a designation by the Bureau of Mines, that:

(1) Reinforcement plies shall be of fabric and/or cord or steel cable.

(2) There shall be friction and skim coats of fire-resistant compound.

(3) The top and bottom covers shall be of the fire-resistant compound.

(4) A breaker may or may not be included in top cover.

(5) In addition to the friction coat, the thickness of the skim coat will be specified.

(6) The covers, friction and skim coat compound will be specified. The method of selecting samples and the tensile requirements of the rubber, as well as adhesions, will be established. The fire-resistant test method and procedure will be established also, and the inspection as well as rejection procedure will be outlined.

In addition to the above, the following items probably will also be included in the Bureau of Mines Bulletin on Fire-Resistant Belting:

(1) The conveyor belting repair material should be of fire-resistant compound.

(2) The lagging of the drive and other pulleys where this type of covering is used, should be of fire-resistant compound.

(3) The use of protective devices to prevent overspeeding or run away should be used on incline and decline belts where this hazard could occur.

The Bureau of Mines will not conduct tests for approval for use as fire-resistant belting on a product which has not been completely developed and is not ready for commercial production. In other words, no tests will be made on belting in which the fabric, cover compounds and manufacture are in a preliminary stage of design and development.

The critical temperature in belting under friction test has been indicated as being less than 500° F or 260° C.

The details of branding the belting as being fire-resistant is in the process of being definitely established and suggested depressed lettering with designated location will be determined soon.

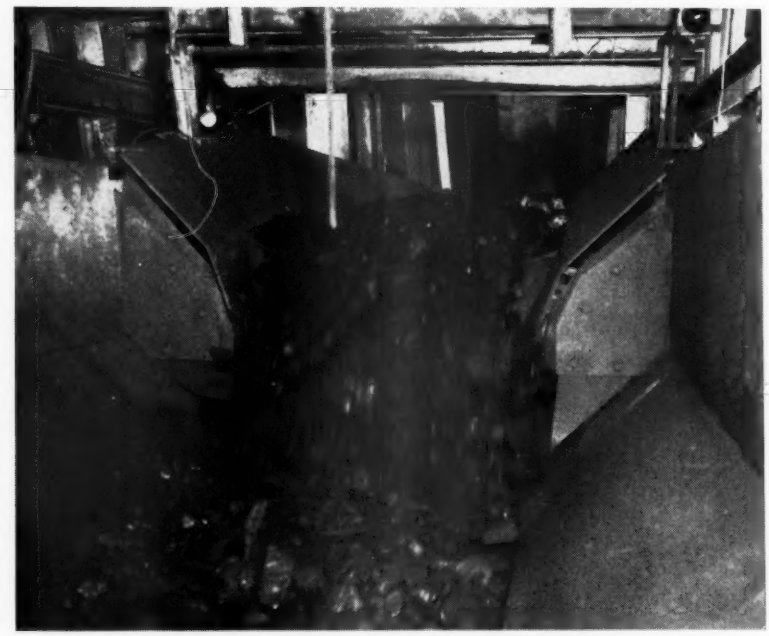
A question raised sometimes is whether or not there is liberation of phosgene, a toxic gas, when Neoprene compound covers are burned. The product referred to is carbonyal chloride and it is a poisonous gas containing carbon monoxide and a chlorine compound. Recent tests of burning Neoprene indicate no evidence, or only a trace, of phosgene present. The conclusions presently are that suffocation from the large volume of smoke or other non-toxic products would occur before asphyxiation.

When there are any changes to be made in the compound which had been previously approved by the Bureau of Mines, further testing of the new product when completed, will be required.

Earlier Reports

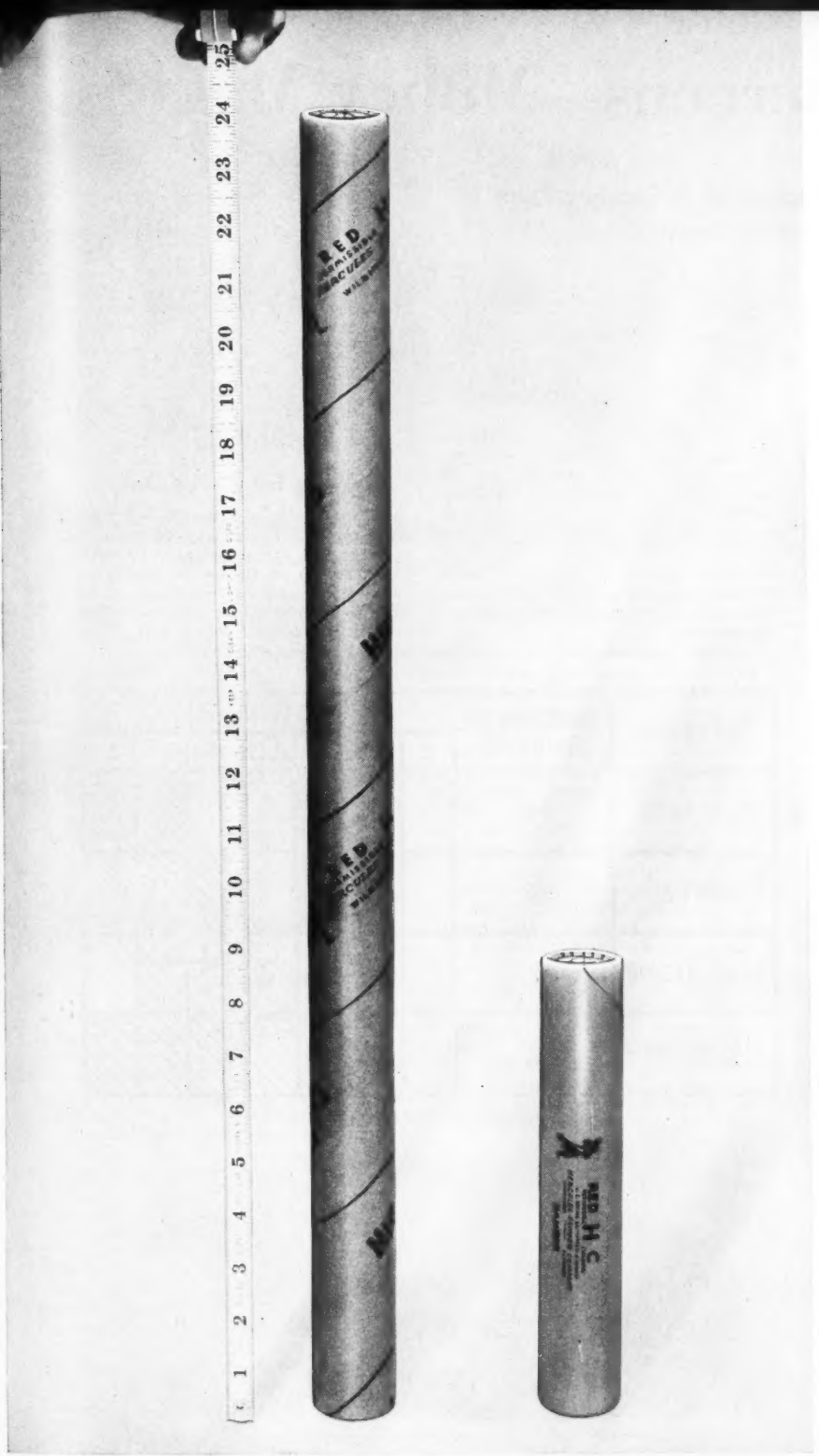
It was the consensus of opinion at the Conveyor Committee meeting in Huntington referred to above that some mention should be made of protective devices to be used in connection with the operation of underground conveyor belting installations. This feature has been rather fully covered in several papers, and the most recent is a subcommittee report by Mr. S. T. Allsbrook on "Belt Fire Prevention" published in the MINING CONGRESS JOURNAL, October 1953. Since the subject of protective devices has been fully covered by previous reports, we refer to those papers if further detailed description is required. One exception, however, deserves additional emphasis and is noted below.

One type of protective device should receive more than passing mention. It is essential that slippage control be inaugurated regardless of the type belting used. It is just as important to utilize this protection even when probable that other hazards also will be eliminated entirely or at least materially reduced. An occurrence of driving mechanism continuing to operate when the conveyor is stalled would be prevented. A centrifugal type switch installed on the bottom side of the top run of the conveyor belt near head pulley has proved entirely satisfactory. This device is available from several electrial manufacturing companies.



Care in belt loading to prevent spillage is important

It is with great pleasure that the subcommittee presents this first phase of our progress report on Fire-Resistant Belting. The committee members present at the meeting in Huntington on June 22, 1955 were in complete agreement on the contents included here and also concurred in the Bureau of Mines "Proposed Schedule for Testing Conveyor Belts for Fire-Resistance."



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HERCULES

XR55-8

Scalping Screens—Money Makers

Useless Work Can Be Decreased If Crusher Feed Is Screened to Remove Small Sizes

By W. S. SHIRA

Processing Machinery Dept.
Allis-Chalmers Mfg. Co.

SCALPING primary crusher feed to remove fines and dirt is good insurance against crusher damage and shutdown and reduces horsepower requirements and maintenance expense. The cost of a scalping grizzly or screen is much less than the cost of replacing a broken mainshaft or frame.

Crusher feed size is determined by the character of the stone or ore (relative softness or hardness, fracture, etc.) the mining methods used and the size of the shovels and trucks used for loading and transporting the material to be crushed.

The crusher receiving opening is made large enough to accommodate the maximum one way dimension of the majority of the largest pieces expected. However, it may not necessarily be the largest piece that can be handled by the loading shovel which can usually pick up pieces that would bridge in the crusher feed opening. Any pieces too large to enter the crusher receiving opening must be reduced by secondary blasting.

The selected crusher must handle the capacity required at the predetermined setting including all of the quarry fines produced by blasting as well as the dirt accompanying the stone.

Take Out Small Particles

Since the size of these particles is already smaller than the close side setting, the crusher does no work on them and functions merely as a chute to transfer them to the conveyor below the crusher. Under these conditions the crusher becomes the most expensive chute obtainable.

If the crusher feed is dirty or contains clay, there is always the possibility of packing in the crushing chamber, thus creating possibilities of damage to the crusher, drive or motor, and necessity of a shutdown to clear the crusher. (See table I.) Finally, the fines and dirt occupy a volume in the crushing chamber and tend to increase the horsepower required to operate the crusher and increase wear on the head and concaves.

Where the primary crusher feed is dry and free from sticky materials or where high capacity is not required, a stationary grizzly can be used ahead of a primary crusher. The disadvantages of the stationary grizzly are low capacity, tendency to plug up or blind due to sticky feed or wedge shaped pieces which lodge between the bars, low screening efficiency, and excessive headroom requirements.

Vibrating screens or grizzlies have high capacity in a small space, do not require excessive headroom and are efficient and free from blinding. They should be of very heavy construction to withstand the shock of large pieces of stone or ore and to handle the high tonnages fed to the larger primary crushers. The vibration amplitude should be large enough (⅜ in. to ½ in.) to throw near size pieces out of the apertures to prevent plugging and the slope should be steep enough to insure a rapid conveying rate for high capacity.

Designs for Every Duty

Figure 1 shows a scalping grizzly of heavy design. The deck consists of three sections with a step between which serves to turn over the large pieces so as to pass through stone which otherwise might ride over. The grizzly bars are of the straight type with the opening flared to prevent

MATERIAL	HARDNESS (Relative)	REDUCTION RATIO						
		2	2.5	3	3.5	4	4.5	5
TACONITE	18						PACKING	PACKING
QUARTZ	15					PACKING	PACKING	PACKING
LIMESTONE	12				PACKING	PACKING	PACKING	PACKING
PHOSPHATE	2			PACKING	PACKING	PACKING	PACKING	PACKING

Table I—Conditions where packing begins

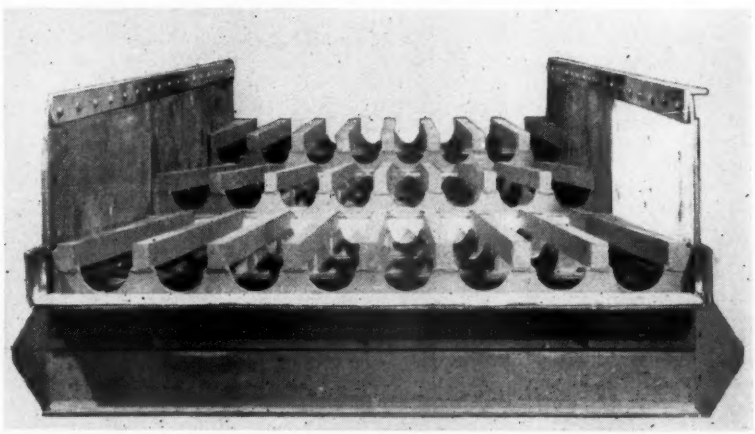

Fig. 1—Scalping grizzly screen with straight type grizzly bars

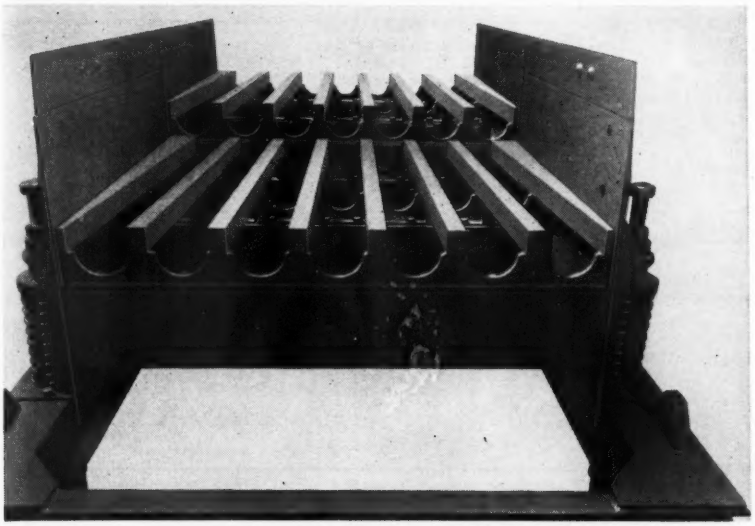

Fig. 2—Scalping grizzly screen with double tapered bars

Fig. 3—Scalping screen with grizzly bars mounted on pedestals

wedging. Figure 2 shows a deck using double tapered bars. In this type the grizzly bars are located parallel with the sides of the screen and are tapered longitudinally as well as from top to bottom.

To facilitate dismantling and maintenance the grizzly bars are welded to cross plates which are bolted to the cross members of the screen frame so that a group of bars can be removed as a panel. The cross plates can be scalloped as shown in figure 1 or the bars can be mounted on pedestals as in figure 3. This permits wedge or carrot shaped pieces to slide between the bars without hanging up on the cross members of the screen frame. If the bars are welded to flat plates as in figure 1, the height of the bars should be about 1.4 times the opening to prevent hang up of slabby pieces.

Grizzly decks are preferred for scalping because of their high capacity and freedom from plugging. It is sometimes desirable, however, to use square openings. A deck of this type is shown in figure 4. This deck is bolted directly to the cross supports of the screen frame and the plate is reinforced by heavy bars, called skid bars, welded between each row of holes. These bars serve to slide the large pieces over the deck and prevent excessive wear on the perforated plate.

The screen side plates should be protected from wear by abrasion of the material. The illustrations show renewable liner plates bolted to the side plates. Grizzly bars, perforated deck plates and liner plates can be made of manganese steel.

Screen body cross supports should be heavy enough to withstand impact of large pieces dropped several feet onto the screen deck. The minimum depth of the cross members is 6 in. with a maximum of 12 in. for very large, heavy pieces in the feed. Cross members are subject to wear from material falling through the deck above and should be provided with wearing plates as shown in figure 5.

Screens of the type described above are suitable for openings ranging from four in. to ten in. and are capable of handling pit run stone or ore such as would be fed to a primary crusher.

Estimating Screen Capacity

For estimating purposes Table II gives the sizes of scalping screens for use with various primary crushers. Crusher capacities are based on crushing a clean limestone of average hardness and are not necessarily the maximum obtainable. Variations in screen analysis, type of material, etc., will affect the scalping screen size and capacity. The pit run material is assumed to have the following analysis:

Passing 8 in. 68 percent
Passing 6 in. 52 percent
Passing 5 in. 44 percent
Passing 4 in. 36 percent
Passing 3 in. 27 percent

The table shows the largest single screen considered practical, however, two smaller screens could be used so that operation could continue while one screen was shut down for maintenance.

Screen Installation

Scalping screens can be fed directly from a receiving hopper, but should be preceded by a feeder to smooth out surges due to intermittant dumping. Stationary skirts are usually placed above the screen to prevent spillage.

Scalping screens are not always placed directly ahead of the primary crusher. In some instances they are located in the quarry or at an intermediate point.

Scalping Screens with Secondary Crushers

Secondary crusher sizes are determined by the indicated capacity,

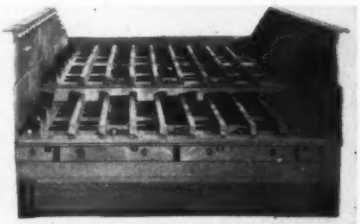

Fig. 4—Grizzly screen equipped with square openings in the deck

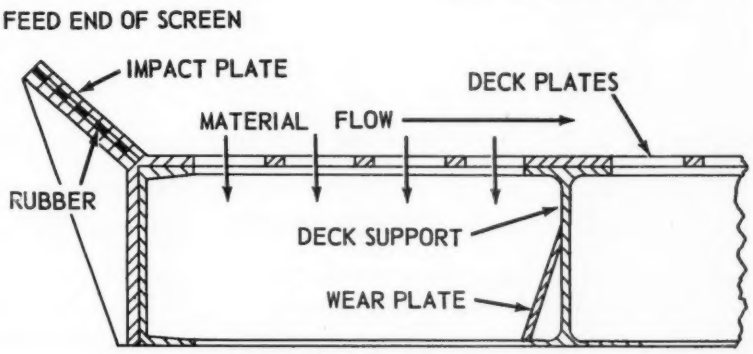

Fig. 5—Section through scalping screen deck

maximum size piece discharged by the primary crusher and the reduction ratio desired. Capacity has a much greater effect on secondary crusher sizes than on primary, in fact most manufacturers rate their crushers on the basis of a scalped feed. Additional stress on secondary crusher capacity is required by the frequent operation of these crushers in closed circuit with the scalping screen.

Scalping screens for secondary crushers are of lighter construction than for primary crushers since the feed sizes are smaller and smaller size separations are required. Both grizzly bar and square opening perforated plate are used, but since the range of apertures used is much larger than on primary scalping screens, the screen construction differs somewhat.

For the larger apertures the grizzly deck or perforated plate deck may be used. Where the maximum feed size does not exceed 16 in. and the aperture range is from one to three in. the rod deck screen shown in figure 6 may be used. The rods vary from ⅝ to one in. in diameter depending on the opening and are individually mounted. This type of screen is ideally suited for handling moist and sticky stone or ore. The stepped construction turns over the larger pieces as well as permitting wedge shaped pieces to freely discharge without "hang up" on the cross members of the screen frame.

When openings smaller than one in. are required and the feed size does not exceed six in. the rod deck screen shown in figure 7 may be used.

Crusher Size	*Max. Feed Size, In.*	*Max. Setting, In.*	*Max. Capacity TPH*	*Scalping Screen*		
				Size	*Aperture*	*HP*
30"[1]	25	4½	965	2-5x12	4½	20
24"[1]	19	4½	620	1-6x12	4½	15
1784[2]	11	2	1050	2-5x12	2	20
1260[2]	7	2	515	1-5x10	2	10
1084[2]	5	1½	735	1-5x12	1½	10
760[2]	4	1¼	340	1-6x12	1¼	10
548[2]	3	⅞	207	1-5x12	⅞	10

[1] *Superior McCully* Crusher.
[2] *Hydrocone* Crusher.

Table III—Selection of secondary crusher and scalping screen

Size No.	*Pulverator*		*Scalping Screen*		
	Max. Feed Size. In.	*Max. Capacity TPH*	*Size*	*Aperture*	*HP*
1	3	12	1-3x6	3/16	2
3	3	48	1-4x8	3/16	3
424	6	80	1-5x14	3/16	10
436	6	120	2-5x12	3/16	15
448	6	160	2-5x14	3/16	20

Table IV—Scalping screens in closed circuit with hammermills

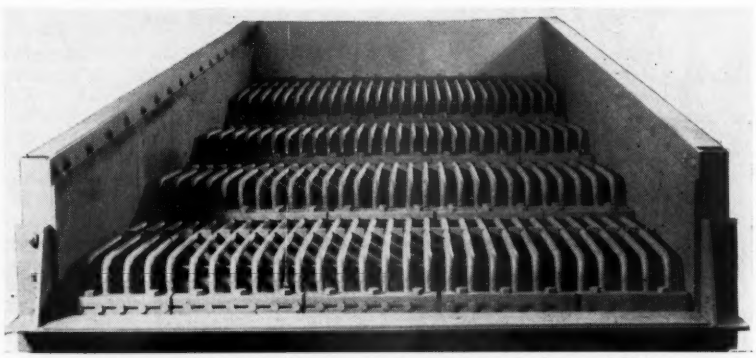

Fig. 6—Rod deck scalping screen for maximum feed size of 16-in.

GYRATORY CRUSHERS

Shovel Size Cubic Yds	*"Superior" Prim. Crusher*	*Open Side Setting*	*Capacity TPH*	*Scalping Screen*		
				Size	*Aperture*	*HP*
5½-6	60-89	7	1500	6x14	7	20
5 -5½	54-89	6	1000	5x14	6	20
4½-5	48-74	5½	750	5x12	5½	15
3 -4½	42-65	5	500	5x10	5	15
2 -2½	36-55	4½	300	4x8	4½	10
1½	30-55	4	250	4x8	4	10
¾-1¼	20[1]	3	125	3x8	3	7½

JAW CRUSHERS

Shovel Size Cubic Yds	*"Superior" Prim. Crusher*	*Open Side Setting*	*Capacity TPH*	*Scalping Screen*		
				Size	*Aperture*	*HP*
5	84x66[2]	10	500	5x10	10	15
3½-4½	84x60[2]	8	350	5x10	8	15
3	60x48[3]	6½	500	5x10	6½	15
2½	48x42[3]	5½	400	5x10	5½	15
1¾-2	42x40[2]	4	150	3x8	4	7½
1½	42x32[3]	4	250	4x8	4	10
1 -1¼	36x25[3]	4	200	4x8	4	10

ROLL CRUSHERS

Shovel Size Cubic Yds	*"Fairmont" Prim. Crushers*	*Setting*	*Capacity TPH*	*Scalping Screen*		
				Size	*Aperture*	*HP*
2½	36x60	6	350	5x10	6	15
1¾-2	24x60	5	300	4x8	5	10
1 -1½	24x48	4	175	4x8	4	10

[1] *Superior McCully* Crusher.
[2] *Superior* Jaw Crusher.
[3] A-1 Jaw Crusher.

Table II—Selection of shovel, primary crusher and scalping screen

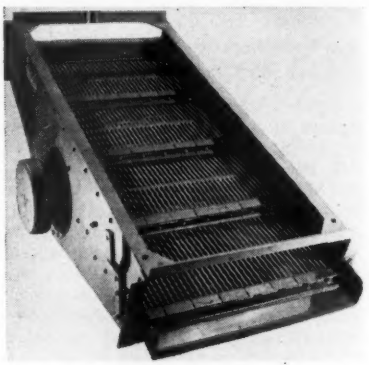

Fig. 7—Rod deck scalping screen with deck openings of one in. or less and maximum feed size not exceeding six in.

In this type the rods vary from 3/16 in. to ½ in. in diameter and are individually mounted in rubber spacer blocks so that individual rods may be replaced when worn. This type of screen is best suited for scalping feeds to small secondary or tertiary crushers or hammermills.

Table III may be used for estimating the capacity of secondary scalp-

(Continued on page 92)

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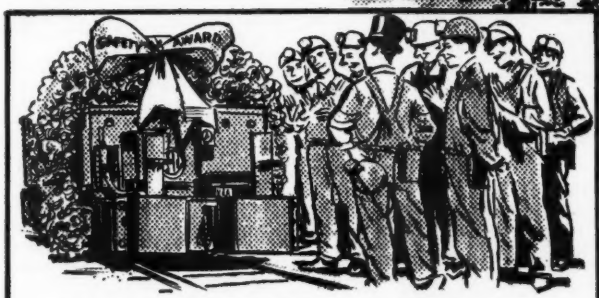

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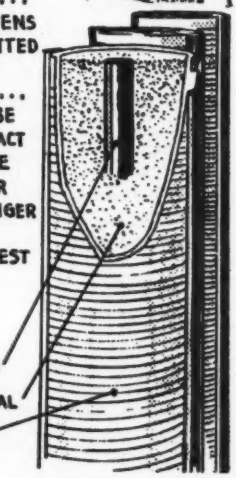

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Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Operators Corner

Tips for the Bond Welder

Or How to be Sure the Job is Well Done*

THE strongest chain is only as strong as its weakest link—the finest rail bond is only as good as the weld that holds it to the rail.

If, for example, the rail isn't thoroughly cleaned before welding, if the weld bead is spotted with burned metal, if insufficient metal is deposited, or if improper current and voltage fail to give adequate penetration, you'll have a weak link in the chain of bonds that holds your circuit together.

These are a few of the many welding faults that can drastically lower the efficiency of rail bonds. And they're only a token of the infinite number of problems that a good bonder has learned to master through years of experience on the job. His knowledge extends far beyond the basic points mentioned in this article, but the suggestions that follow may prove helpful to the inexperienced bonder and may offer a tip to older hands as well.

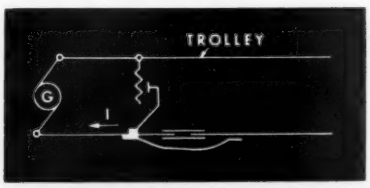
Clean the Rail Thoroughly

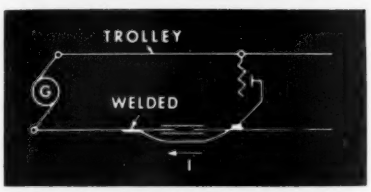
Both the bond terminal and the rail surface should be clean and dry before welding. If the rail is covered with a heavy scale of rust, the deposit should be removed with a cold chisel, after which the surface can be wire brushed down to bare metal. Coal or rock dust, grease, paint, etc., should also be removed to permit a solid, nonporous weld of minimum electrical resistance and high mechanical strength.

Use Correct Voltage, Adequate Current

The heavier the welding rod, the greater the current required for good penetration and dense bead. For example, a current of 120 to 130 amps is about right for 5/32-in. steel rod, but about 150 amps are needs for a 3/16-in. rod.

Best results are obtained with an arc about 1/8-in. long. A longer arc throws burned metal into the weld and gives an uneven bead—poor electrically as well as mechanically. The short arc gives better penetration and at the same time allows less exposure of the rod particles to air. Maintaining the proper length of arc is a skill that comes only with experience.





Figs. 1, 2—WRONG: Welding terminal nearest substation first (fig. 1) forces welding current through the bond as the second terminal is welded (fig. 2). The current sets up an electromagnetic field in the terminal, causing the arc to blow out frequently and making proper length of arc difficult to maintain

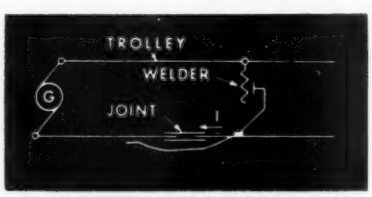


Fig. 3—RIGHT: Correct sequence is to weld the terminal farthest from the substation first; the one nearest the substation last. This forces current through the rail and joint plate, not the bond, as first terminal is welded. (No current flows through bond or joint plate as the second terminal is welded

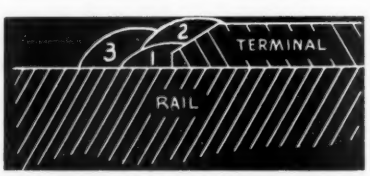


Fig. 4—Three beads, put down as shown, make a high-strength low-resistance bond. Numbers indicate order in which each bead is made

Use the Proper Welding Sequence

The first terminal to be welded to the rail should always be the one farthest from the power source. The reason for this, as shown in figures 1, 2 and 3, is to keep the welding current flowing through the rail joint rather than the bond itself. If this procedure is not followed, current will flow through the bond during the welding (because the bond offers a lower resistance path than the rail joint) and set up an electromagnetic field around the terminal. Such fields often cause the arc to blow out and make it difficult to maintain proper arc length.

Don't Try to Finish Job in One Pass

Remember that good electrical conductivity as well as mechanical strength are necessary in bond welding. Since steel has only about one tenth of the conductivity of copper, the area of the weld should theoretically be ten times the copper cross section. This area can be reduced in practice, of course, because of the short length of the steel in the circuit.

For best results three beads are recommended, laid as shown in figure 4. The first bead is laid between terminal and rail, being slightly heavier on the rail. The second bead is laid between the first bead and the terminal itself. The third bead joins the second to the rail and completely covers the first, as shown.

Use Good Materials

The cheapest bond isn't necessarily the most economical. The time it takes to install it, the length of time it remains in service, and the kind of job it does when installed—whether it offers high or low resistance to the current in the circuit—are all important considerations.

* Article and illustrations courtesy of the Ohio Brass Co.

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Wheels of GOVERNMENT

As Viewed by HARRY L. MOFFETT of the American Mining Congress

THE first session of the 84th Congress adjourned early in the morning of August 3 after shelving a number of the Administration's proposals, including the atom-powered peace ship, customs revision, Social Security Act changes, and the Government executives' pay bill.

Prior to adjournment a number of measures were snarled in legislative tangles, among them being the public housing bill and differing House and Senate versions of the measure to revise and extend the Defense Production Act. For a time it looked as though these bills might also be sidetracked in the rush of adjournment. However, differences were compromised and the measures sent to the White House. Both are in a form that do not meet wholehearted Administration approval and it may be that the White House will seek revision of them at the next session.

Other major legislation, however, did not receive such treatment and a number of important measures were not finally acted upon. These included the Federal highway program, exemption of natural gas producers from direct Federal rate regulation, and the catch-all "bobtail" tax bill. These were laid aside for further consideration at the next session.

Legislation that was not finally enacted during the first session does not die. It retains its present status when the next session gets under way and can be acted upon at any time.

Washington is filled with rumors that a special session may be called this Fall to obtain action on a public housing bill more suitable to the Administration, and on the proposed Federal highway program. The timing of such a session, now being discussed by Administration leaders, will be left to the President. Barring a special session, Congress will return January 3, 1956.

During the first session, the mining industry fared fairly well. The general mining laws were revised to remove the main causes of abuses of those laws and to open up to mineral development many millions of acres of the public domain; domestic mineral purchase programs were continued and goals raised; adequate appropriations were enacted for stockpiling and for carrying out the various mineral activities of the Federal Government; a mine drainage program for the anthracite area was authorized; the mineral raw materials exemption in the Renegotiation Act was continued, and authority was extended for the mineral exploration and expansion programs in the Defense Production Act. No changes were made in the Taft-Hartley Act, and no legislation was enacted which would hamper coal, mineral or metal development. Drives to obtain tariff relief for hard-hit segments of the domestic mining industry failed of enactment but changes were made in the Trade Agreements Act, which, if properly administered, may open the way for fair treatment for domestic industries suffering heavy damage from imports.

Defense Production Act

In the closing hours of the session, a major roadblock to adjournment was removed when both House and Senate agreed to a one year's extension to June 30, 1956, of the Defense Production Act.

The Senate had approved a two-year extension to June 30, 1957, and had written in a provision limiting businessmen serving the Government "without compensation" to advising on policy decisions. The House had voted a one-year extension but had laid down somewhat stricter rules relating to Government employment of dollar-a-year men. Heated controversy developed over the amendments and it appeared for a time that the Act would not be revised at this session but that a short term continuation would be voted to keep the present law in effect until Congress could arrive at a final compromise. However, these differences dissolved in the push for adjournment and both Houses agreed to the one-year extension, and to a provision calling for businessmen serving "without compensation" in Government to give a strict accounting of their assets, liabilities, sources of income, and gifts on taking office, and periodically thereafter.

As approved by Congress, the new Act renews until June 30, 1956, the President's authority to purchase metals, minerals and other materials, and to encourage exploration, development and mining of strategic and critical metals and minerals. It is under this authority that mineral exploration and expansion programs are conducted.

Minerals Purchase Programs

In the final days of the session, both Houses adopted the Engle (Dem., Calif.) bill, H. R. 6373—which continues the scheduled termination dates of domestic minerals purchase programs for tungsten, manganese, chromite, mica, asbestos, beryl and columbium-tantalum ores, and authorizes Government purchase of double the quantities specified for these programs as of July 1, 1953.

The bill reestablishes the Wenden, Ariz. manganese ore-buying depot and provides for the establishment of two additional manganese ore depots to

★ ★ ★ ★ ★ ★ ★ Washington Highlights

CONGRESS: Adjourns until January.
DEFENSE PRODUCTION: Act extended one year.
MINERALS PROGRAMS: Goals doubled.
MINING LAW: Revisions enacted.
OIL IMPORTS: Restrictions sought.
ANTHRACITE: Drainage program adopted.
NATURAL GAS: Harris bill progresses.
SILVER PURCHASES: Drive for repeal.
TAXES: Catch-all bill held in committee.
MINIMUM WAGE: Rate hiked.
HIGHWAYS: Program stalled.

★ ★ ★ ★ ★ ★ ★

serve the Ozark-Cushman area and the southern Appalachian area.

To purchase the additional quantities provided for, the measure directs ODM Director Arthur Flemming to enter into gross purchase transactions not to exceed $150,000,000 in addition to amounts required to purchase the full quantities of all materials authorized to be purchased under programs existing as of July 1, 1953.

The Senate had amended the bill to establish a purchase program for domestic antimony but a House-Senate Conference Committee struck this from the measure.

Public Lands Legislation

One of the outstanding accomplishments of the past session was the enactment of Public Law 167 (signed by the President on July 23), which will eliminate abuses of the mining laws and provide the Government with a procedure with which to clear up title uncertainties as to invalid, abandoned, dormant or unidentifiable mining claims on the public domain. The new law makes it clear that the miner has predominant rights to use of the surface of his claim for mining and related activities, and provides for a complete title to his claim when it is patented.

The Interior and Agriculture Departments are currently drafting regulations to carry out provisions of the new law and these are expected to be announced in the near future.

Two other measures which would broaden application of the mining laws to public lands were whipped through Congress in the closing days of the session. One of these would open to mineral development all lands withdrawn for power sites while the other would provide for the mining of uranium within seams or beds of lignite.

In the administrative field, the Department of Interior has adopted new regulations under which the public will be kept better informed of the status of public lands. Hereafter notices of withdrawals or restorations of public lands will be posted at local county recorder offices, post offices and BLM State land offices and interested individuals will be notified of the proposed orders.

One of the ablest administrators in the Department of Interior has resigned effective September 15. Orme Lewis, Assistant Secretary of Interior for Land Management, will leave his post on that date to return to private practice of law in Arizona. Authoritative sources have indicated that former Montana Congressman Wesley A. D'Ewart, now an assistant to Agriculture Secretary Benson, may succeed Lewis.

Oil Imports

A pointed hint that Congress may step in to halt heavy imports of oil if the Administration does not act to do so was contained in a letter to ODM Director Arthur S. Flemming signed by 27 Senators. The Senators inquired as to what action Flemming will take to hold oil imports within the levels set by the President and the Congress.

The Senators told Flemming that they viewed with "growing concern" the increasing rate of imports of petroleum from foreign sources with relation to domestic production, pointing out that for the first six months of 1955 this ratio was well above that of 1954, the level recommended by the President's Cabinet Committee on Energy Supply and Resources Policy.

They pointed out that the Trade Agreements Act was extended with the understanding that the executive branch would take the necessary action to prevent oil imports from exceeding levels set by the Committee.

Anthracite Drainage Program

A measure providing for the expenditure of $8.5 million of Federal funds, on a 50-50 matching basis with the State of Pennsylvania, for the control and drainage of water in anthracite coal formations was signed into law by the President (Public Law 162). Passage of this legislation was first urged in 1942.

Another measure affecting the anthracite industry was introduced by Rep. Flood (Dem., Pa.) but was not acted upon during the session. It would authorize the Federal Government to make purchases of anthracite for two years in amounts sufficient to maintain normal production and employment in the industry. Flood will likely press for action on this proposal next year.

Natural Gas Legislation

During the last week in July, the House whipped through the Harris bill to exempt natural gas producers from Federal rate regulation, but the Senate put the measure in the legislative limbo until next year.

The bill was approved by a margin of only six votes. As passed by the House it did not contain amendments sought by the coal industry which would have given the Federal Power Commission jurisdiction over direct sales of natural gas to industrial consumers, and which would have eliminated below-cost sales to industrial customers.

Objective of the measure is to overturn a Supreme Court decision in the Phillips case, which held that the FPC had the right to regulate producers and gatherers of natural gas. The measure is likely to be subject of heated debate during the next session.

Silver Purchase

A determined drive was opened late in the session to secure repeal of the law requiring the Government to purchase all newly-mined domestic silver at 90.5 cents an ounce. Legislation sponsored by Senator Green (Dem., R. I.) to accomplish this was the subject of hearings before a Senate Banking and Currency Subcommittee, headed by Senator Douglas (Dem., Ill.).

Treasury Under Secretary Burgess testified that the silver purchase program "creates no serious difficulties" for the Treasury Department, and declined to make any direct statement that the Department advocated repeal of the law. Federal Reserve Board Chairman Martin stated that the effects of the law on the Board's operation were very small, but indicated that he, personally, had always been in favor of its repeal.

Assistant Secretary of Interior Felix Wormser emphasized that if the bill were to be enacted it might have a highly damaging effect upon vital segments of the domestic mining economy.

Several witnesses from the silver-consuming industry and Senator Green urged enactment of the measure, stating that the effect of its enactment on the mining industry had been over-estimated by the Interior Department.

During the course of the hearings, the minority members of the Committee, especially Senator Capehart (Rep., Ind.), complained of the manner in which the hearing was being conducted and the "badgering" of Government witnesses. They also made it quite clear that they desired to have opponents of the measure heard fully before any action was taken by the Committee. A large number of Senators signed a letter to the Chairman of the Banking and Currency Committee requesting the right for themselves and others interested in the silver legislation to testify at subsequent hearings. They pointed out that there was little time remaining in the session for complete consideration of the bill, and asked that further hearings be put off until January at which time they wanted the opportunity to testify.

As a result of these strong requests, the subcommittee has scheduled further hearings for early next year, when time will be given to opponents of the Green bill. It is likely that the sponsors of the measure will renew their efforts at that time to push through repeal legislation.

"Bobtail" Tax Bill

The House Ways and Means Committee, in the adjournment rush, put off action on a "bobtail" catch-all tax bill until next year. This bill consisted of some 20 proposals by individual members of the House dealing with such subjects as voluntary pensions, repeal of the 4-cents-per-ton-tax on the transportation of coal, establishment of the duty on unmanufac-

(Continued on page 88)

AMC Personals

Ross D. Leisk, vice-president and general manager of Sunshine Mining Co., was awarded the honorary degree of Doctor of Engineering in early June at commencement ceremonies of the Michigan College of Mining and Technology. The degree was conferred by Dr. Grover C. Dillman, president of the college, in recognition of Leisk's distinguished career of service to his country, his profession and his college.

Richard C. Newbold, formerly president of the Lehigh Navigation Coal Sales Co., has been appointed vice-president in charge of sales for the El-Tronics, Inc., Philadelphia, manufacturers of geiger and scintillation counters.

Edward W. R. Butcher, chief mining engineer for the Northern Ore Mines of the Republic Steel Corp., recently retired. Butcher joined Republic as mining engineer at Gilbert, Minn., on the Mesabi range in 1909. From 1917 to 1918 he was engineer at the Cambria mine on the Marquette Range and the Clifford-Traders mine on the Menominee Range, Mich. He was named chief mining engineer in 1918 and transferred to Duluth, Minn. In addition to his duties as chief mining engineer, Butcher was also in charge of industrial relations over a period of several years for Republic's Northern Ore Mines.

W. H. Parker, former executive vice-president of Stith Coal Co., is the new president of the Alabama Mining Institute. He was named to succeed the late I. W. Rouzer.

The appointment of **Julian C. Ashby** as general manager of Utex Exploration Co., Inc., has been announced by Charles A. Steen, president of Utex. Ashby joined Utex about the first of the year as chief geophysicist after ten years' experience in geophysics with Atlantic Refining Co.

Stewart L. Deck has been appointed general manager for Jacob's Fork Pocahontas Coal Co., which operates in McDowell County, W. Va. Deck was a resident engineer for Slab Fork Coal Co., superintendent of the firm's Mary Gaston No. 10 mine and superintendent of the Brooklyn mine of the Scotia Coal & Coke Co.

Dr. J. Carl Behler has been elected president of Minerals Processing Co., LaGrange, Ga. Dr. Behler has served as a director of the company since its beginning.

Minerals Processing, which operates properties both in the LaGrange area and in North Carolina, produces mica, beryl, and quartz.

Charles R. Bourland has been elected president of the New River Co., succeeding J. A. Hunt, who will remain as a member of the board of directors. Hunt will continue to serve the company on a part-time basis to discharge special duties assigned by the board. Succeeding Bourland as vice-president in charge of operations is **W. A. Haslam.**

Chas R. Bourland

W. A. Haslam

Bourland joined the New River Co., which operates coal mines in Fayette and Raleigh Counties, W. Va., in 1944 as assistant to the vice-president in charge of operations. Later he was elected vice-president of operations.

Haslam joined New River four years ago, also as assistant to the vice-president of operations. Before that he had been associated with the Pond Creek Pocahontas Co.

Two appointments in the Exploration Division of the Grand Junction Operations Office of the U. S. Atomic Energy Commission have been announced. **John G. Barry** is the new staff engineer in the office of Division Director E. R. Gordon, and **Arthur E. Granger** has been named chief of the Geologic Branch. Barry succeeds **David D. Baker,** now deputy director of the Mining Division, and Granger succeeds **Robert J. Wright,** who resigned recently to enter private business.

Theodore Barry, management consultant, has formed a new company, Theodore Barry and Associates, with offices at 3055 Wilshire Blvd., Los Angeles. The new firm is currently serving clients in the fields of wage plans, management, audits, organization, production planning, executive recruitment, marketing, cost controls and foreman training.

Robert D. Hill has been elected vice-president and controller of Freeport Sulphur Co., according to an announcement made by Langbourne M. Williams, president.

Hill succeeds **Richard C. Wells,** who resigned as controller of Freeport to become president of National Potash Co., a newly formed company jointly owned by Freeport and Pittsburgh Consolidation Coal Co. Hill has been associated for the last five years with the Taylor Wharton Steel Co., having served successfully as treasurer, vice-president and executive vice-president.

Minott Brooke, general fuel service engineer for the Chespeake & Ohio Railway Co. in Huntington, W. Va., retired June 30 under the company's retirement plan. Brooke had 21 years of service with the railroad company and had been affiliated with the coal traffic engineering department during the entire period.

Three new appointments were announced following Brooke's retirement. **T. H. Duffy** was appointed general fuel service engineer at Huntington, **A. S. Morton** is now fuel service engineer at Richmond, Va., and **C. S. Dennis** is assistant fuel service engineer at Greensboro, N. C.

Thomas J. Hubbard, former maintenance and construction engineer of the Hurley plant of Kennecott Copper Corporation's Chino Mines Division in New Mexico, became general master mechanic of the Magna Mill, Utah Copper Division, July 1. Hubbard succeeded Albert J. Fitzgerald, who retired following 40 years of service with Utah Copper Division.

Gregory S. Devine has resigned as vice-president and a director of the Truax-Traer Coal Co.

W. Julian Parton has announced that he recently disposed of his holdings in the Panther Valley Coal Co., Inc., Lansford, Fa., of which he was president and chairman of the board. Parton was president of the Lehigh Navigation Coal Co. when mining operations were suspended by that firm in June 1954. Last October 1, he and three associates organized the Panther Valley Coal Co., Inc., and leased the Lansford District mines and colliery.

Parton has entered into consulting work.

J. E. Berg retired June 30 as general manager of American Smelting & Refining Company's northwestern mining department after 32 years with the company and its subsidiary, the Federal Mining & Smelting Co. Federal was merged with the parent firm in 1953. Berg will continue to serve the company as a consultant.

J. C. Kieffer succeeds Berg. He in turn will be succeeded as assistant general manager by **Sergei C. Zelenkov,** who has been manager of Asarco's Northern Peru Mining & Smelting Co.

Two top-level appointments at the McDowell County, W. Va., mines of United States Steel Corp. have been announced by **L. M. Lineberry,** Gary District superintendent. **Paul H. Duncan** is now assistant to the district superintendent, replacing Robert Cooper, retired. **Hal M. Scrugham** succeeds Duncan as superintendent of the Gary No. 6 mine.

Michael A. Kuryla has been named assistant manager of the Lima, Peru, division of the Cerro de Pasco Corp., according to an announcement by Robert P. Koenig, president. Kuryla's duties will be concerned in part with evaluating prospective mining ventures in Peru, where Cerro de Pasco already ranks as the country's largest nonferrous mining enterprise.

Kuryla served most recently as director of safety and employe services for the United States Smelting Refining and Mining Co., Salt Lake City, and formerly was engaged as a mine and mill superintendent by Cia. Real del Monte y Pachuca, Pachuca, Mexico.

Arthur C. Hewitt, The Warner Co., Bellefonte Division, Bellefonte, Pa., retired recently after nearly 30 years as chief engineer. He started in this position on June 1, 1925, for the American Lime & Stone Co. at Bellefonte and continued in the same capacity when The Warner Co. acquired the property.

Frank Coolbaugh, president of Climax Uranium Co. and vice-president for western operations of Climax Molybdenum Co., has been elected a director of Climax Molybdenum Co.

H. O. Zimmerman, manager coal properties, Inland Steel Co., Wheelwright, Ky., recently announced the appointment of **Arthur Bradbury** to be assistant to manager coal properties. Bradbury served as safety director for Inland's coal mines during the past 14 years. In addition to his new duties he will remain in charge of the safety department.

The National Lead Co. announced on June 16 the resignation of **Paul W. Allen,** plant manager of the company's Ilmenite Mines at Tahawus, N. Y. Allen tendered his resignation effective July 1, to accept a position with the Cyprus Mining Co. He will be located in Los Angeles.

John Hall, assistant plant manager at Tahawus the past 2½ years, succeeded Allen on July 1. Hall immediately announced the appointments of **Archie McDonell,** chief engineer, and **Charles Begor, Jr.,** general superintendent, to the positions of assistant plant managers.

John Hall

—*Obituaries*—

Francis C. Van Deinse, 78, retired general manager and vice-president of Yuba Consolidated Gold Fields and president of Yuba Manufacturing Co., died recently in San Mateo, Calif., following a long illness. Mr. Van Deinse was active in the mining industry for many years. He served for about eight years on the California State Mining Board and for 17 years he was vice-president and general manager of Ventura Oil Co. In 1929 he was appointed California's first "oil umpire" after major oil companies organized to avoid depletion of supplies and to allocate production.

Robert C. Fitzgerald, 70, former vice-president in charge of sales for the West Virginia Coal & Coke Corp., died May 19 at his home in Cincinnati, Ohio.

Rufus E. Zimmerman, 68, retired vice-president and chairman of the Research Policy Committee, U. S. Steel Corp., of Short Hills, N. J., died June 21 following a brief illness.

Dr. Zimmerman first became associated with steel research in 1914 when he joined the American Sheet and Tin Plate Co., which later became a part of U. S. Steel. During his 38 years in the industry his career was devoted to research for better steels and new uses for steel products. He pioneered methods of refining low grade taconite ores, the development of techniques of ship welding, explored uses for steel mill wastes, and was instrumental in the development of electrolytic tinplate.

Dudley Denison Homer, 68, mining executive, died in Boston, Mass., May 15. Mr. Homer was managing director and treasurer of Minas De Matahambre, a large Cuban copper mine, for 22 years. Before that he was with the American Metal Co., Ltd., and was assistant manager of the Butters Didisdero Mines in San Salvador. He retired in 1952.

Roch P. Botsch, 71, chairman of the board of the North American Coal & Dock Co., died of a heart attack June 2.

Grant Wheat, 71, inventor of the Wheat Electric Cap Lamp, suffered a fatal heart attack on June 17 in Denver, Colo.

Mr. Wheat, a native of New York State, was a director of Koehler Mfg. Co. with which he was associated for 38 years. He held numerous U. S. and foreign patents covering his inventions in mine lighting. Mr. Wheat resided in Marlboro, Mass., and was active in mining, civic, and fraternal affairs.

1955 Metal Mining and Industrial Minerals Convention

Meeting Plans Shape Up for Outstanding Program

"HOWDY PODNER," will be the greeting when mining men and ladies from all over the United States, Canada, Mexico and other parts of the globe meet in Las Vegas October 10-13 for the 1955 Metal Mining and Industrial Minerals Convention of the American Mining Congress.

At this big meeting they will examine the status of the mining industry and set a course for an active year ahead. Every phase of the business, management and operating ends of mining will be subjected to close scrutiny, and industry-government relations will get a thorough going-over. Advance registration indicates that more than 2000 mining men will take part in the proceedings.

The industry-wide Program Committee has lined up a comprehensive 19-session program that will be well worth the while of everyone interested in mining, from top executives to miners. Cabinet officers, United States Senators and Representatives and other high Federal and State officials will discuss national problems with leading industry spokesmen. Outstanding mining engineers, metallurgists and geologists will review newest methods and equipment for underground and open pit mining, ore treatment and exploration. The special problems of the uranium industry will receive their full share of attention.

Kenneth C. Kellar of Lead, S. D., has been appointed by Howard I. Young, AMC president, and Roy A. Hardy, Western Division Chairman, to head up the Resolutions Committee. A number of subcommittees have been appointed to draft resolutions on: general policy; labor relations; taxation and government expenditures; gold, silver and monetary policy; tariff, stockpiling and mineral programs; public land policy; mine financing; social security; water and air pollution; mine safety; government reorganization; uranium; and energy resources.

The subcommittees in drafting their resolutions will try to reflect the considered views of the industry. To this end they will appreciate suggestions and comments in writing from any mining man. Communications should be sent to the American Mining Congress, Ring Building, Washington 6, D. C. These may take the form of amendments or revisions of the Declaration of Policy adopted in San Francisco last year (see MINING CONGRESS JOURNAL, Nov., 1954, p. 63), or may include views on any topic on which it is felt the industry should take a public stand.

The entire Resolutions Committee will meet in Las Vegas prior to the convention to whip the declarations into final shape. As in the past, the committee will submit its report in sections, at appropriate points during the convention sessions. Thus everyone present will have full opportunity for consideration of these important industry policies, and the press will be able to give them suitable attention.

Mining Congress Conventions are famous for the fun and good fellowship of their social functions. This year will be no exception. On Monday evening a big Western Party is to be held in the Last Frontier Village. This roaring replica of an old-time western town will relive the old days. A real barbecue, cooked over coals in pits dug in the ground, western music and entertainment will make this a party no one will forget.

Other evenings have been left open to allow convention visitors to "do the Strip" as they wish. To help ensure a good time a Hospitality Desk will be maintained by the Resort Hotels Association, where reservations may be made for the shows at any of the member hotels.

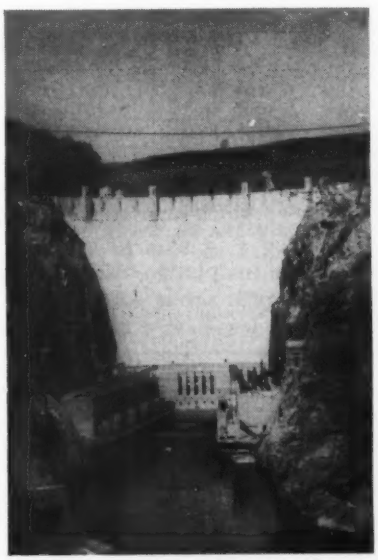
Of course the ladies are welcome at all convention functions, and three special parties have been arranged for them. The first will be a luncheon in the pool-side patio of the Hotel Riviera on Monday. Second is a brunch and style show on Tuesday in the Congo Room at the Sahara, and third is a trip on Wednesday to Hoover Dam and beautiful Lake Mead. This will include a guided tour through the inside of the dam and power plant.

On Thursday two special field trips have been scheduled. One is a 9:30 a. m. to 5:00 p. m. tour to the Molybdenum Corp. of America's famous rare earths mining operations at Mountain Pass, Calif. On the second trip, also leaving at 9:30 a. m., visitors will see the Three Kids manganese mine and beneficiation plant in the morning. After lunch at Henderson, the Western Electrochemical Co. and U. S. Lime Corp. plants will be toured. These are both very interesting operations. Western Electrochemical produces battery grade manganese dioxide and U. S. Lime supplies most of the flux used by the West Coast's growing steel industry.

Application forms for hotel reservations have been sent out and anyone who has not yet made a reservation should do so immediately. Write or wire Las Vegas Housing Committee, Box 1750, Las Vegas, Nev. For motel reservations contact Frank Ellis, Sr., Pres., Las Vegas Motel Association, % Par-A-Dice Inn, 2217 Fremont St., Las Vegas, Nev.

The past year has been an important one for mining and the program at Las Vegas will be a condensed course in what has happened and what is likely to happen. Las Vegas itself is fabulous place that has to be experienced to be believed. For the time of your life—and a thorough briefing on what's new in mining on the legislative, economic and operating fronts —come to the American Mining Congress 1955 Metal Mining and Industrial Minerals Convention October 10-13.

So long, Podner, we'll be lookin' fer you.



Many convention goers will visit Hoover Dam

WHITLEY COLLINS

Portrait by Fabian Bachrach

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MINING CONGRESS JOURNAL

Eastern and Central states

Clay Minerals Conference

National Research Council has cordially invited all mining men to participate in the Fourth National Clay Conference sponsored by the Clay Minerals Committee of the National Research Council. The Conference will be held at The Pennsylvania State University Monday through Thursday, October 10-13, 1955. Field trips and laboratory visits will take place Monday, and papers will be presented Tuesday, Wednesday, and Thursday.

W. Va. Coal Mining Institute

West Virginia Coal Mining Institute held its annual spring meeting at the Daniel Boone Hotel in Charleston, W. Va., June 24 and 25, 1955. Now in its 46th year, the Institute meeting was highlighted by three technical sessions and a dinner at which the principal speaker was the Hon. William C. Marland, Governor of West Virginia.

At the morning session on June 24, the group heard a paper by Victor Hurley, superintendent, Warner Colleries Co., Mammoth, W. Va. He spoke about cost reduction through industrial engineering. Warren G. Montgomery, district sales manager, Jeffrey Manufacturing Co. gave a paper on the performance of the Colmol in low coal.

Following a luncheon meeting, the group heard three more technical papers. First was "Performance of a Goodman Continuous Miner," by Kenneth Hobbs, production engineer, Federal No. 1 mine, Eastern Gas & Fuel Associates. Dr. Aureal T. Cross, coal geologist and paleobotanist, West Virginia Geological Survey, spoke on the origin and the make-up of coal. The afternoon session concluded with "Black Magic" by Prince Thornton, Public Relations Department, Appalachian Power Co.

Two of the three papers on Saturday morning, June 25, were devoted to conveyor haulage. The first, given by J. S. Mathews, Compass Coal Co., Clarksburg, W. Va., was entitled "Continuous Mining with Extensible Belts." Edwin P. Sheriff, Eastern Gas & Fuel Associates, Stotesbury, W. Va., gave a paper on "Roof Control and Its Study Applied to Longwall Mining." A paper on conveyor belt haulage wound up the session and the meeting. It was given by R. U. Jackson, manager, Mining Division, Hewitt-Robins Incorporated.

Record Coal Load

A cargo of 18,391 net tons of coal, carried by the steamship, "J. L. Mauthe," has set a record for coal cargoes carried by American-owned vessels. On June 6 the steamship, a 650 ft long vessel named after the president of the Youngstown Sheet & Tube Co., unloaded the cargo at Youngstown Sheet & Tube's Indiana Works on Lake Michigan. Most of the coal was from the company's own coal mines at Dehue, W. Va.

The record load contained enough coal to fill more than 275 railroad cars having a capacity of 67 tons each.

More Cement Capacity

Ground was broken by the Bessemer Limestone & Cement Co. June 14 for the first unit of a multi-million dollar addition to its plant at Bessemer, Pa. The first unit will have nine storage silos for cement. They will be 120 ft high and 33 ft in diameter. The unit is the first phase of a long-range program which will eventually cost $9,000,000 according to reports.

Training for Safety at Peabody

At appropriate ceremonies on June 6 safety certificates were awarded employes of Peabody Coal Company's Mine No. 43, Harrisburg, Ill., and Mine No. 47 dryer plant at Harco, Ill. The awards were presented for having completed 100 percent training in accident prevention. In all, 21 men were trained at the dryer plant and 213 men at the mine. A total of 1631 Peabody employes in the state have received accident prevention training.

That such a program pays off is shown in a review of before and after statistics. Records show that during 1954, with the training almost completed, there was a 41 percent reduction in all injuries, a 44 percent reduction in lost-time injuries, and a 64 percent reduction in the severity of all injuries.

Minnesota Mines Reunion

The second Alumni Reunion of the Minnesota School of Mines and Metallurgy will be held Friday, October 21, 1955. A technical session is scheduled for Friday at the old school, and in the evening there will be a cocktail hour followed by a banquet and dance at the Nicollet Hotel. Saturday will be Open House followed by the Michigan-Minnesota football game. Make reservations for tickets and hotels early by contacting R. L. Dowdell, 306 Appleby Hall, Minneapolis 14, Minn.

Jamison No. 9 Working Again

The Jamison No. 9 mine of the Pittsburgh Consolidation Coal Co. is back in operation. Two sections of the mine went into production in late July and the four remaining sections are scheduled to be in operation in early October.

The mine was wrecked by an explosion which swept the underground areas last November 13, killing one outside worker and 15 others underground. The last of the 15 bodies of the entombed men were not recovered until May 30. Rehabilitation work was started June 3.

Mining Mica

Hassett Mining Co. of Burnsville, N. C., began extracting mica from TVA's Davy Crockett Lake near Greeneville, N. C. in May.

Building Cement Plant

Construction of a new Portland cement plant at Paulding, Ohio, with an annual productive capacity of about 1,250,000 bbl has been announced by the Consolidated Cement Corp. of Chicago. The plant, expected to be in production by the fall of 1956, will be on the site of the company's limestone quarry now supplying limestone for a plant at Cement City, Mich.

The company reports that the new facility will not replace either of its two other plants but will be an addition to present production facilities. Consolidated's Cement City, Mich., plant has an annual production capacity of about 1,150,000 bbl and the Fredonia, Kan., plant can produce approximately 2,300,000 bbl annually.

Holmes Chapter Organized

The first chapter of the Holmes Safety Association to serve an ore mine in the South has been established at Bessemer, Ala. The chapter will serve the Edwards ore mine of Republic Steel Corp. and will be affiliated with J. J. Forbes Council of Birmingham, Ala. Q. B. Lee was elected chapter president.

Safe Worker

Fifty-one years work in and around coal mines under one management without a single lost-time accident is the outstanding record of a retired Raleigh County, W. Va., mine worker.

March Gillenwater, 66-year-old electrician, retired May 31 after serving for more than half a century under the late W. Gaston Caperton and his son, S. Austin Caperton.

His safety mark is matched only by his work record, which officials say shows no absenteeism since starting his career with the Slab Fork Coal Co., 47 years ago.

Public Relations

Oliver Iron Mining Division's Pilotac taconite plant at Mountain Iron, Minn., and its open pit mine observation stands on the Mesabi range were opened to the public on June 28, according to an announcement by R. T. Elstad, president of the U. S. Steel division. "They will remain open to Minnesota tourists and vacation visitors through Labor Day, and this season we expect to greet our one-millionth visitor," he said.

Oliver's observation stands are located at Eveleth, Virginia, Chisholm, Hibbing, Marble and Taconite. This summer two additional stands will be operated making a total of eight. One will be located at the company's new Plummer mine at Taconite and a second one will be put into service at Hibbing. Nearly 200,000 people visited Oliver's operations last year.

Princess Elkhorn Scholarships

The Princess Elkhorn Coal Co., David, Ky., has announced the recipients of its 11th annual scholarship award. The five award winners this year bring to 46 the number of grants made to outstanding graduating seniors in Floyd and Johnson Counties, Ky.

Currently there are 13 young people attending college under the scholarship program. Five are at Pikeville College, Pikeville, Ky., of which three will transfer to the University of Kentucky next fall; one is attending Eastern Kentucky State College; one is attending Georgetown College at Richmond, Ky.; one is attending St. Marys School of Nursing at Huntington, W. Va.; one is attending Ohio University; and four are at the University of Kentucky.

The scholarship awards this year were made to:

Donald F. Capelli, of David; four-year grant for the study of engineering at the University of Kentucky. Joseph L. Marshall, of David; four-year grant for the study of mechanical engineering at the University of Kentucky. Myrtle Tussey, of Water Gap; a two-year grant for the study of a business course at Pikeville College. Mary Lou Miller, of Cliff; a two-year grant to prepare at Pikeville College for the teaching of English. Peggy Sue Allen, of Langley; a four-year grant to study Veterinary Medicine at the University of Kentucky.

All of the recipients of the scholarship awards are sons and daughters of employes of the Princess Elkhorn Coal Co. except Miss Allen, whose father is maintenance supervisor for the Floyd County Board of Education.

Shown above is the new $2,600,000 Appalachian Experiment Station of the U. S. Bureau of Mines at Morgantown, W. Va. The station was dedicated in appropriate ceremonies on May 14. The group of seven principal structures will be devoted to three principal activities: petroleum and natural gas research, studies in the gasification of coal, and administration of the Federal Coal Mine Safety Act.

Spotlight Ontario Copper

Copper has stimulated a great deal of exploration activity in Ontario. A survey of field work in the province shows exploration activity in four widely-spread areas.

Two areas which have commanded most interest are the Tashota district of Northwestern Ontario, and the section of Algoma lying about 60 miles north of Sault Ste. Marie. Tech-Hughes is starting drilling at the former, while Sylvanite Gold Mines is the key operator at the latter.

Copper has also induced considerable activity in other districts. There has been some new staking near the heart of the Porcupine camp. Few details are known but it seems evident from available information that exploration activity will be under way before long with at least two groups active.

The copper discovery in the Grenville formation northwest of Minden touched off a brief staking bee. A stepped-up development program is getting under way on the Dupel group, on which the discovery was made.

There are other areas, too. The greenstone band extending west from the Teck showing at Tashota has been the scene of extensive staking. Quebec Chibougamau, in the central part of the belt, has completed three holes with sulphide intersections. Glenora, further west, starts drilling shortly.

It appears evident that quiet exploration work will continue through the winter on prospects in the Manitouwadge district, where Geco Mines last winter proved up Ontario's first major copper orebody outside of the Sudbury district.

Chip Mines, sponsored by Consolidated Howey and Tech-Hughes, is drilling towards a main anomaly underlying Lake Manitouwadge. Willroy will continue its program on the ground lying immediately west of Geco.

Missouri Mines Scholarships

Nine freshman scholarships for the Missouri School of Mines and Metallurgy, at Rolla, Mo., sponsored by the Alumni Association, have been announced by Dean Curtis L. Wilson, of that institution, and H. S. Pence, president of the Missouri School of Mines Alumni Association.

The scholarships carry a cash award of $500 for the freshman year and are based upon high school scholastic standing and leadership participation, and the comparative results of engineering aptitude tests. With the exception of one scholarship there are no geographic restrictions. Applications for these scholarships must be on file prior to February 1 for entrance for the fall semester.

Establish Geology Dept.

Formation of a geology department headed by John A. Brown, chief geologist, has been announced by Minnesota Mining & Manufacturing Co., St. Paul, Minn.

The new department, which is part of the company's roofing granule division, was established to meet the increased demand for geologic services in connection with quarrying operations and to evaluate new sources of rock for roofing granules. Currently the company has quarries at Wausau, Wis., Corona, Calif., and Little Rock, Ark.

Reopen Gauley No. 2

On May 31 the Gauley No. 2 Mine of the Elk Lick Coal Co. reopened after a two-year shutdown. Construction has been started at the Richwood, W. Va., mine on a storage bin which is scheduled to have a capacity of 1000 tons. Superintendent of the mine is now Herb Seelinger, formerly associated with the Johnstown Coal & Coke Co. in West Virginia and Pennsylvania.

Join Hands in Columbium Deal

Molybdenum Corp. of America and Kennecott Copper Corp. recently revealed plans to jointly develop a columbium and tantalum ore deposit located at Oka near Montreal, Que., Can. The venture is subject to approval of the necessary agreements, now being prepared.

Plan Monument

Plans are under way for memorial rites at historic Wheeling Suspension Bridge, at Wheeling, W. Va., in recognition of the contributions of engineering to the United States, and to the ingenuity of the master bridge builder, John A. Roebling, who redesigned and built the structure in its present form.

The initial meeting to formulate plans for the occasion was held on July 11 at the Wheeling Steel Building, attended by a group of prominent engineers, representing the Wheeling Chapter of the West Virginia Society of Professional Engineers and the counterpart of the organization in Ohio, as well as others interested in the project. A working committee was appointed to carry out plans which include a memorial in the form of a large bronze tablet suitably inscribed and provided by John A. Roebling's Sons Corp. of Trenton, N. J.

Repairs to the present bridge are planned to keep it in use. The memorial ceremony is planned for shortly after these repairs have been completed.

WANTED

Mining Congress Journal offers excellent opportunity for mining engineer with coal or metal mining experience. Position involves writing and working with members of the mining industry.

Address inquiries to the Editor. Include information on age, education, experience, marital status and a recent photograph.

Invitations to the ceremony will be extended to the governors of West Virginia and Ohio and the presidents of engineering societies of both states. Other guests will include Dr. David B. Steinman, noted engineering authority and author of "The Builders of the Bridge," and F. W. Roebling, III, vice-president-engineering of the Roebling Corp. and a great-great-grandson of John A. Roebling, whose Brooklyn Bridge still stands as a monument to his memory. An invitation also will be sent to the governor of Virginia and the president of the state's engineering society. The century-old span was constructed during the period when West Virginia still was a part of the state of Virginia.

Blue Coal Corp. Sells Blue Coal

Effective July 1, Delaware, Lackawanna and Western Coal Co., wholesale coal susbidiary of Glen Alden Corp., will change its name to Blue Coal Corp., it was announced by Francis O. Case, president of Glen Alden.

The purpose of the change is to tie in with the 'blue coal' trade name long associated with the products of Glen Alden. It represents another step in the company's efforts to strengthen its promotion of coal and heating equipment under the 'blue coal' label.

The subsidiary's present identity goes back to 1909 when it was organized as the coal selling agency of the Lackawanna Railroad. It was acquired by Glen Alden in 1925.

Dun Glen Closed

Start of the coal miners vacation June 26 marked the end of operations for the Dun Glen mine of Hanna Coal Co. Coal left in the mine, located at Dun Glen, Ohio, will be removed through the new Glen Castle mine located between Harrisville and Shepherdstown, Ohio. Glen Castle and Piney Fork are the only underground mines now being operated by Hanna Coal Co., a subsidiary of Pittsburgh Consolidation Coal Co.

Foremanship

(Continued from page 57)

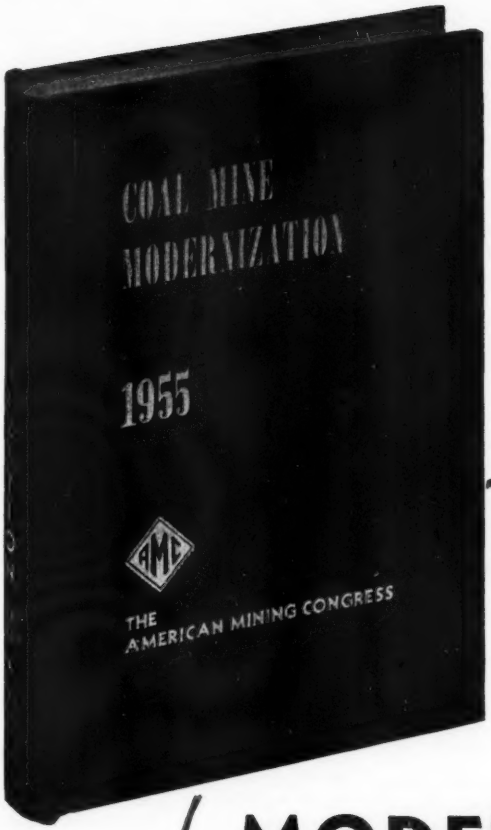
duce illuminating results, and will in many cases bring about a very beneficial self-analysis.

After a considerable amount of information has been collected, following several surveys, the need for further training programs for *all* supervisors should become apparent. The information will be especially valuable in that it can be used to draw up schooling for specific areas of deficiency as uncovered by the surveys.

The only real objection to an evaluation system was stated by one operator who said, "We already have good morale, and our superintendents know each of the section foremen as well as they know their own brother. So why is a system needed?" The answer in the first place is that very often we think we know a person or a situation from top to bottom, when we may be only scratching the surface. Secondly, no one man's opinion is infallible: a consensus of several evaluations on each man, with no man being overlooked, presents a more accurate and unbiased picture.

The system and program described applies to a company having approximately 100 members of mine management, operating six mechanized mines which produce about 2,000,000 tons of coal per year. The more supervisors a company or group of companies have, the more obvious is the value of such a program. However, smaller producer units can utilize a similar program to good advantage, and it must be emphasized that the program should be tailored to fit the individual need.

Our company has been experimenting with personnel evaluations for less than a year. It is difficult to foretell what new developments may lie ahead. But from the experiences of companies in other industries, and from the benefits we have already begun to observe, we may be opening a door to added profits.



COAL MINE MODERNIZATION-1955

A well-kept storehouse is a place where things are put away, ready and available for use.

Coal Mine Modernization is such a storehouse—chuck-full of mining ideas and information, all carefully prepared and arranged for convenient use by practical mining men. Each year the industry is combed for all that's new in both underground and strip mining operations as subject material for the Mining Congress' Coal Convention . . . and then all the papers and discussions are packed into COAL MINE MODERNIZATION. The 1955 edition will be coming along soon—hence the offer of "Another Storehouse for Sale—$3.50."

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BOOK REVIEWS

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS. *34th Annual Issue for the year 1954 published by American Bureau of Metal Statistics, 50 Broadway, New York 4, N. Y. Price, $3.00 postpaid.*

EACH year the American Bureau of Metal Statistics compiles a statistical picture with respect to the economics of the nonferrous metals on a world-wide basis.

Among the commodities covered are copper, lead, zinc, gold and silver, aluminum and bauxite, antimony, cadmium, magnesium, cobalt, molybdenum, nickel, platinum and tin. Also included are tables showing the average monthly and yearly prices of the principal metals for the years 1900-54 and a section toward the end of the book shows the United States duties on principal ore and metal imports.

Information for the publication is gathered in close cooperation with governmental departments and private institutes and associations.

The information compiled by the American Bureau of Metal Statistics is available to the general public through subscription for periodic reports and the Year Book.

METAL STATISTICS—1955. *Published by the American Metal Market, 18 Cliff St., New York 38, N. Y.*

JUST out is the 48th volume of Metal Statistics. It contains a new quick reference index with instructions for its use on the front fly leaf. The new edition contains the same general assortment brought up to date, of statistical information on ferrous and nonferrous metals and miscellaneous economic subjects as previous issues. Sixteen pages longer than the 47th annual edition, the new volume contains a number of new statistical tables on such subjects as annual shipments of products by domestic copper and brass mills; primary aluminum producing capacities of the United States and Canada; consumption of nickel in the U. S. by uses; annual production, shipments of stocks of brass and bronze ingots in the U. S., and official specifications for zinc die casting and zinc base alloy ingot.

Prices quoted, according to custom, are generally based on the quotations published in American Metal Market and are representative of wholesale selling prices.

With the absence of reliable data covering Iron Curtain countries, world totals are, of necessity, estimated.

ELECTRONS ATOMS METALS AND ALLOYS, *by William Hume-Rothery, O.B.E., F.R.S. The Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y.—379 illustrations. Price $10.*

This book employs dialogue between the Older Metallurgist and a Young Scientist to explain the application of the electron theory to metallurgy. Those of us who, like the Older Metallurgist, are more conversant with the every-day mining, extraction or fabrication or the common metals than with higher mathematics and theoretical chemistry and physics will find the discussions well within the limits of our understanding. However, to quote the Young Scientist, "The subject is not one to read in spare time in railway trains or while lunching in a restaurant. But if you are willing to sit down quietly from time to time and think things out, there is no reason why you should not grasp what is going on—at any rate you could get a general idea so that some of the stuff at the Institute would be more interesting to you."

Those who take the time to eavesdrop on these conversations between the Older Metallurgist and the Young Scientist will find out that the latter was right.

BIBLIOGRAPHY ON URANIUM IN ARKANSAS, IOWA, KANSAS, LOUISIANA, MINNESOTA, NEBRASKA, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA AND TEXAS. *The Geological Society of America, 419 West 117 St., New York 27, N. Y. 70 pages, price 50 cents.*

THE Geological Society of America published this article in the March 1955 issue of its Bulletin. Compiled by Margaret Cooper for the Division of Raw Materials, U. S. Atomic Energy Commission, the information in the 70 pages of this bibliography may prove helpful to geologists and laymen interested in uranium prospecting.

The Society has prepared reprints for public sale at 50 cents each. Remittance must accompany orders.

Wheels of Government

(Continued from page 76)

tured mica at 4 cents a pound regardless of value, and repeal of the $3.50 per ton import duty on crude silica.

Committee members had expressed the opinion that the bill was so heavily weighted with controversial items that it would be headed for a certain veto. The measure, however, is sure to be overhauled at the next session and could form the basis for general revenue revision.

The House Committee did approve and send a bill to the floor to provide for accelerated amortization (five years) of that portion of the cost of treatment works for the abatement of stream pollution approved by State and Federal authorities charged with administration of pollution laws.

Meanwhile, the Senate Finance Committee put off action on the House-approved measures to amend the customs laws and to expand Social Security benefits and increase Social Security taxes.

Excise tax revision is also in the making for next year. The House Ways and Means Committee has named a subcommittee to make a study of inequities in the Federal excise tax structure during the Congressional recess and to come up with suggested revisions early next session. The study group is headed by Rep. Aime Forand (Dem., R. I.).

Minimum Wage Boosted

The Senate and House have sent the President a measure increasing the minimum wage rate from 75 cents to $1 an hour effective March 1, 1956. This is 10 cents an hour more than the President sought.

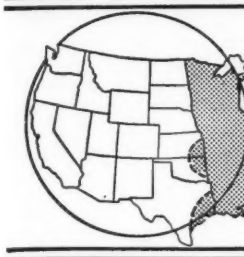
The bill does not extend the Act's coverage as was requested by the White House, but does carry a provision requiring the Secretary of Labor to make an annual review of the adequacy of the minimum wage and to propose a change in the $1 rate if he so desires.

The President has indicated that he will sign the bill.

Federal Highway Program

The Administration's plan for financing an extensive highway program through bond issues was stuck in the legislative cooler during the adjournment rush. Prior to shelving the bill, the House had substituted a plan to pay for the roads through increases in Federal taxes on gasoline, diesel fuel, trucks and heavy tires and tubes. The substitute proposal had been amended, as advocated by the American Mining Congress and others, to exempt from the proposed tax increases any vehicles and machinery which are used exclusively in off-the-highway work.

The program was of such a highly controversial nature that Congressional leaders overlooked pleas from the White House for action at this session and put the matter over until next year. It is expected that Mr. Eisenhower will push hard for enactment of a highway program before the 84th Congress quits next year, and may even seek a special session to deal with his plan.



Western States

Utah Phosphate Expansion

Western Phosphates, Inc., has announced a $2,000,000 expansion program at its phosphate reduction center at Garfield, Utah. The company is a joint affiliate of Stauffer Chemical Co. and Garfield Chemical & Manufacturing Co.

It was reported that the program at Garfield would include about a 40 percent increase in the over-all production of ammoniated phosphate and treble superphosphates.

Partially responsible for the new expansion program is the availability in 1956 of anhydrous ammonia from the new $18,000,000 ammonia plant being built at the Geneva Works of Columbia-Geneva Steel Division, United States Steel Corp. Reports indicate that between 30 and 40 percent of the entire 200-tpd output of the U. S. Steel ammonia plant will go to Western Phosphates.

Arizona Ore Buying Station

A new AEC ore-buying station and sampling plant at Globe, Ariz., was opened on July 5. The new station is operated by American Smelting & Refining Co.

In addition to carnotite and roscoelite-type ores, the sampler will purchase autunite, torbernite and uraninite ores with less than six percent lime content. Special contracts may also be negotiated with individual producers for purchases of ores not meeting announced specifications.

Calaveras Expands

The board of directors of Calaveras Cement Co. have approved a $4,000,000 expansion plan which will add a fifth rotary kiln to the company's plant at San Andreas, Calif., and increase plant productive capacity by 30 percent.

The new kiln, which will be fabricated by Allis-Chalmers Mfg. Co., will be 360 ft long with a diameter of 11 ft 3 in. Also provided in the expansion program are auxiliary items including coolers, dust collector, multiclone, thickener, and raw and finish mills.

The company's 1955 plant betterment program, previously approved, includes the erection of four new cement storage silos, plus quarry, plant and shipping department improvements already completed. These installations were authorized in anticipation of the fifth kiln program acted upon June 23. When completed, the kiln will raise productive capacity of Calaveras to approximately 4,500,000 bbl per year.

Bunker Hill Goes Mine-Mill

Employes of Bunker Hill & Sullivan Mining & Concentrating Co. have voted to retain the International Union of Mine, Mill and Smelter workers as their bargaining agents. The vote was 956 for mine-mill, 319 for the CIO U. S. Steel workers, and 72 for no union—of 1765 eligible to vote, 1347 cast a ballot.

Idaho Mercury Production

Rare Metals Corp., affiliate of El Paso Natural Gas Co., will begin production of mercury at its new refinery and mine near Weiser, Idaho, early in August, according to M. H. Kline, vice-president and general manager. The reduction center, which is claimed to have the largest single rotary kiln for quicksilver production in the world, is now in process of erection and will have a rated input capacity of 175 tons of ore daily. Meanwhile, cinnabar deposits are being readied for open-pit mining operations.

Uranium Exploration By-Product

Discovery of two apparently commercial bodies of beryllium ore north of Santa Fe, N. M., and rumors of a third strike in the same general area have pointed up the fact that the search for uranium is tending to hasten the development of all forms of mining in New Mexico. In many other instances, besides the three beryllium strikes referred to, deposits of ores and minerals other than uranium have been found by those tramping the hills in search of radioactive minerals.

United Western Minerals Co., Santa Fe, owns and is operating one of the beryllium strikes north of Santa Fe. Mica is also being mined along with the beryllium.

Mineral Survey in Nevada

A mineralogical survey of the territory in Nevada served by the Western Pacific Railroad will be made during the coming months, the railroad has announced. The survey will cover the area from Portola, Calif., to Winnemucca, Nev., and from Reno Junction to Reno, Nev. The area is a highly mineralized one, and the railroad believes that many deposits may be awaiting discovery. The survey will consist of an examination and appraisal of all known mineral resources in the region. The railroad said it is not interested in acquiring or exploiting the property itself.

Butte First Aid Contest

On the 79th anniversary of the founding of the Butte Miner's Union on June 13, 1955, known as Miners Union Day, the annual first aid contest sponsored by the Anaconda Co. at Columbia Gardens in Butte was won by a team composed of shift bosses from the Leonard mine in Butte. Eighteen teams competed for cash prizes posted by the company and the competition was keen.

The Leonard bosses' team compiled a total of 2488 points out of a possible 2500. Second place went to the Lexington mine team with 2480 points and third place was won by the Emma-Travona team with 2476 points. All teams were close when the points were added up, highest score as noted above was 2488, lowest was 2433 points.

Members of the Leonard bosses' team included Joseph Pagliero, Chester Gilles, Carl Huhtanen, John R. Riley, William Wills and Herbert Egedahl. In the Lexington team were Ed Sullivan, James Garrett, Earl Best, Thomas Torpy, Frank Davis, and Dennis Byrnes. Third place Emma-Travona team included Walter Forsty, John B. Sullivan, William Prendergast, Donald Jeffery, Vince Benninger and John J. Murphy.

Coppermines Scholarship

The Kimberly Office of Consolidated Coppermines Corp. has announced the winner of the Coppermines' Foundation, Inc. Scholarship for the year 1955. Thomas Gardner Keegan was this year's recipient. He is the son of Mr. and Mrs. William Keegan of Ely, Nev.

Keegan plans to attend the School of Business at the University of Nevada and will major in accounting. The award was made public by J. Frank Sharp, superintendent of Consolidated Coppermines Corp., in an address to the student-body of the White Pine County High School May 26. Coppermines' Foundation Scholarship consists of an annual award of $500 each year for a four-year college term, provided the recipient's scholastic record while in college is deemed to be of college caliber.

Consolidated Coppermines Corp. established Coppermines' Foundation Inc. in 1954 as a means of financing scholarship in White Pine County and similar community activities in connection with their mining activities in White Pine County.

Verdi Buys Gold Mill

The Verdi Development Co., of Los Angeles, operators of the Rosamond uranium mine near Rosamond, Calif., has purchased a former gold processing mill which will be converted into a uranium milling plant. The plan has been approved by the board of directors of the company, according to Clifford Gillespie, president.

The Beck mill, located within seven miles of the mining property of Mount Soledad, Calif., includes most of the equipment the company will need for processing uranium, Gillispie said.

A co-discoverer of the Rosamond mine, Gillispie also reported that the company has completed extensive exploration on its properties and that mining is actually under way on three different leases.

Sell Prospecting Permits

Sale of uranium prospecting permits on two units of land on the Fort Apache Indian Reservation brought a total of $43,613.43 into tribal coffers, it has been announced by John O. Crow, agency superintendent. Bids were opened at 2 p. m., June 22 in Whiteriver, Ariz.

Atomic Ores, Inc. of Globe, Ariz., was successful bidder on Unit No. 1 paying $13,062.93 for the right to prospect for one year on 19,723 acres in the southwest corner of the reservation. Frost Geophysical Corp. of Albuquerque, N. M., paid $30,550.50 for prospecting rights for one year on Unit No. 3, comprising 24,169 acres, lying in Navajo and Gila Counties along the reservation's west central boundary. No bids were received on Unit No. 2, an area of 41,308 acres situated between Units Nos. 1 and 3.

The prospecting permits carry with them the right to select a lease or leases on not to exceed 1920 acres in each unit. The successful bidders have indicated their intention to explore the units fully and to develop any uranium ores found in commercial quantities.

As a result of the interest shown in the June sale, it is probable that additional tribal lands on the Fort Apache Reservation as well as areas on the adjoining San Carlos Apache Reservation may be offered for prospecting and leasing. Information concerning uranium prospecting and leasing on these reservations may be obtained by writing John O. Crow, superintendent of the Fort Apache Reservation, at Whiteriver, Ariz., or Thomas H. Dodge, superintendent of the San Carlos Reservation, at San Carlos, Ariz.

New Office Building

Work has started on a quarter-million dollar office building for the Potash Division, International Minerals & Chemical Corp. at Carlsbad, N. M. Estimated to cost more than $250,000, the new structure will contain 12,000 sq ft of office space. It will be completely air conditioned and will make it possible for the first time to house offices of all staff officers in one building.

Utah Uranium Pilot Plant

Vitro Uranium Corp. has announced the award of contracts for a pilot plant at its Salt Lake City mill for the development of a new process for the reduction of uranium ore. The company will spend about $100,000 in this experimental work, according to R. C. Cole, plant manager, who said "This plant will study the commercial applications of an extraction process which, though not new in uranium recovery, is untried commercially in the uranium mining field."

This test work will explore the commercial possibilities of streamlining and possibly expanding the Salt Lake uranium mill of Vitro Uranium Corp. by early 1956.

Bayview Resumes Operations

Echo Day Lead-Silver Mines, Inc., is to resume operations at its property near Bayview, Idaho, according to E. C. Schaeffer, president and general manager. A ramp is being constructed to the tunnel portal in a rock cliff 50 ft above the shore line of Pend Oreille Lake, which will facilitate handling of mining equipment and supplies.

Schaeffer said the tunnel will be extended about 100 ft to beyond a fault where a geophysical survey has indicated the downward extension of a surface mineralized zone.

Anderson Phosphate Mine

As a result of favorable exploration in recent years, the Montana Phosphate Products Co., is materially expanding its Anderson mine near Garrison, Mont. A five-mile rail extension will be built from Phosphate Siding up Brock Creek to the Junction of the Anderson mine and Relyea mine roads.

The company will develop underground haulage by means of a 10,700-ft cross-cut adit, to be driven to the phosphate bed from a point in Brock Creek Valley three miles south of and 600 ft below the collar of the present Anderson shaft. A service-way, inclined 60°, will be raised 800 ft from the end of the adit to open three upper levels on the ore bed. Ore from these upper levels will be dropped to the main haulage level and brought to the surface through the new adit.

The Brock Creek adit will become the center of activities at the Anderson mine area and surface buildings are being erected in the vicinity. When the new haulage tunnel is completed in 1957, the mine will produce 1000 tpd of phosphate rock.

Scalping Screens

(Continued from page 70)

ing screens. It is based on open circuit screening and on a feed from the primary crusher of which 85 percent passes the open side setting. If the screen is operated in closed circuit with the crusher, increased screening area should be provided to take care of the circulating load.

Scalping Screens with Hammermills

Hammermill type crushers are often operated with grate bars to control the top size of the crushed product. These can be a source of trouble and high maintenance especially when crushing on abrasive material. Some operators have found that removing the grate bars and operating the mill in closed circuit with a scalping screen can considerably reduce the cost of operating. For example, a cement plant operated one season with a grate bar spacing of 3/16 in. to make an agricultural meal. The following season a scalping screen was installed in closed circuit and the grate bars removed. The life of the hammers was increased from two weeks to 45 days, and operating costs were reduced about 70 percent. Table IV shows recommended sizes and capacities of screens in close circuit with hammermills. The table is based on crushing limestone of medium hardness. The capacities indicated will vary with other materials and degrees of hardness. The screen sizes shown are based on a 3/16-in. aperture and must be changed if different apertures are used.

Cerrillos Reopens

According to William E. Scorah president, Western Development Co. plans to reopen the long-abandoned Cerrillos mining district south of Santa Fe and to build a mill to process lead—zinc ore there. It is hoped that some of the non-ferrous mines in the district will be operating by early summer. There may also be commercial quantities of uranium and other minerals in the area. In addition to its plans for a custom mill Western Development Co. has also acquired exclusive mining and prospecting rights on 17,000 acres south of the lead-zinc mining area. A mill in the district will eliminate the necessity of shipping ore to El Paso for processing.

Uranium Safety Awards

U. S. Vanadium Co., operating subsidiary of Union Carbide & Carbon Corp., and Four States Uranium Corp. have won the 1954 safety awards of the Colorado State Insurance Mining Association. U. S. Vanadium was the winner in the "big company" class of operators on the Colorado Plateau, while Four Corners took first place in the "small company" class.

Gas and Coke from Gilsonite

A program to manufacture metallurgical coke and high-test gasoline from Utah's native Gilsonite deposits was recently announced by the American Gilsonite Co. of Salt Lake City, Utah.

The project calls for expenditure of more than $10,000,000 to expand Gilsonite mining operations at Bonanza, Utah, to construct a refining plant in Western Colorado, and to lay a connecting buried pipeline to supply raw material to the new plant.

American Gilsonite, jointly owned by the Barber Oil Corp. and Standard Oil Co. of California, expects to begin construction sometime this fall, with completion scheduled for late 1956.

Gilsonite is a unique hydrocarbon mineral in solid form and has been mined at Bonanza since 1904. Until now, Gilsonite's principal uses have been in the manufacture of floor tile, storage battery boxes, special varnishes, inks, and other products.

American Gilsonite's decision to refine this raw hydrocarbon on a commercial scale was made after many years of research. For the past three years the company has conducted pilot plant operations at Bonanza to test earlier research findings.

Pilot plant experiments indicated that commercial manufacture could turn out a high-grade electrode coke of exceptional purity which would find a ready market in the manufacture of aluminum, and in specialty carbon fields. It was developed also that the co-product gasoline which could be made from Gilsonite was of excellent quality, and with octane ratings equivalent to modern aviation fuels.

When American Gilsonite's new refinery goes on stream, its raw material will be mined underground for the first time by hydraulic methods. The company estimates it can increase by several times its present output at Bonanza. After mining, the Gilsonite—water mixture will be pumped through an eight-in. pipe line to the new plant where it will be dried for use as feed to the refinery units.

It is estimated that the refinery's initial capacity will be 600 to 700 tpd of Gilsonite. The plant will utilize a fractionator and a catalytic reforming process to turn this solid hydrocarbon into gasoline and intermediate products, and to supply liquid feed for a delayed coker. Gas released by the process will be used as fuel in the operation of the plant.

Moab Uranium Mill

The Atomic Energy Commission and the Uranium Reduction Co. of Salt Lake City have signed a contract for the construction and operation by Uranium Reduction of a uranium ore processing plant at Moab, Utah. Construction of the new plant will start immediately and is expected to be completed within 12 to 15 months. Mill design which has already been completed is based upon extensive metallurgical and pilot plant work conducted during the past year. In terms of capacity, the Moab Mill will be one of the largest in operation.

The new mill will be situated on property adjacent to the AEC ore buying and sampling plant just north of Moab on U. S. Highway 160 and will process ore from properties owned, leased or controlled by the company and also ore bought from independent producers or the AEC. A provisional buying station at Moab had been operated for AEC by the American Smelting & Refining Co. during 1954 and a mechanical sampling plant went into operation on February 1, 1955.

Edward H. Snyder will be board chairman of Uranium Reduction Co. The controlling interest in the new company is owned by Utex Exploration Co. in which Charles A. Steen, president, is the principal stockholder.

American Zinc, Lead & Smelting Co. has purchased 1,750,000 shares (14.6 percent) of the common stock of Uranium Reduction for an undisclosed sum, according to Howard I. Young, president. In addition, American Zinc has contracted to manage Uranium Reduction. Richard A. Young will be executive vice-president of the new company and will be in charge of construction, operations and finances. Neither of the Youngs will receive any salary from the new company, it was asserted.

Financing was arranged by Kuhn, Loeb & Co., investment bankers, in collaboration with Foley Bros., Inc., of Pleasantville, N. Y., who will construct the mill at Moab. After completion of the financing, directors and principal officers of the company will be Edward H. Snyder, board chairman; Mitchell A. Melich, president; Charles A. Steen and Richard A. Young, vice-presidents; E. T. Foley, Percy M. Stewart, and Howard I. Young, directors.

Progress at San Manuel

Magma Copper Co., in its annual report to stockholders, reported that underground development and plant construction at San Manuel, Ariz., progressed satisfactorily during 1954. Present plans anticipate that construction will be completed by December 1955.

Alaskan Exploration

Five mining companies or their subsidiaries are scheduled to participate in intensive exploration in Alaska this summer.

Bear Creek Mining Co. is reported to be sending a field party into the Green Butte area on the Copper River, while Northern Pyrites, Inc., a subsidiary of Texas Gulf Sulphur Co., will explore iron deposits on Latouche Island 40 miles east of Seward.

It is also reported that U. S. Steel Co., W. S. Moore Co. of Duluth, Minn., and the American Smelting & Refining Co. will investigate iron deposits in the territory.

Lucky Friday Shaft

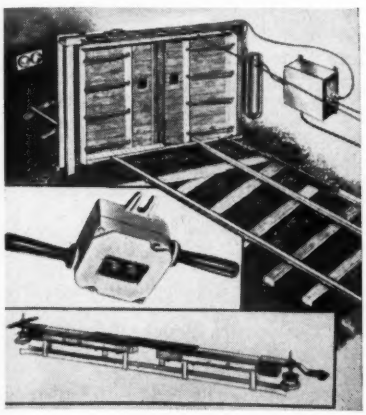
The new three-compartment shaft raise at the Lucky Friday Silver-Lead Mine east of Mullan, Idaho, reached the adit level two weeks ahead of schedule, according to Dave Elder, mine superintendent. Crews are now extending the shaft upward an additional 127 ft to provide head room for sheaves and ore-handling facilities.

The shaft raise was started late in February 1954, from 70 ft above the 1800-ft level and has been pushed as the principal development project at the property. The rate of advance averaged almost six ft per working day.

Manufacturers Forum

Automatic Mine Door

American Mine Door Co., Canton 6, Ohio, is celebrating its golden anniversary. In conjunction with this event it has introduced a new mine



door for installation where a mechanically operated door is impractical. Called the Type P door, it is operated by air and is designed particularly for location on curves or in places where water and mud would hinder mechanical action of the door. The air cylinder which opens the door can be activated by manual control or by trolley contact for automatic operation where trolley equipment is used.

Explosion-Proofed Flashlight

Automatic circuit cut-off to prevent fire or explosion is featured in new line of safety flashlights by Eveready. Safety features are built around two phenolic parts compression and plunger molded by Auburn Button Works Inc., Auburn, N. Y.

Safety is achieved by use of a spring-loaded contact within the reflector assembly. A wire bulb guard runs through two slots in the phenolic reflector and is attached to the spring-loaded phenolic retainer. If the bulb is broken, the electrical circuit is opened instantly before the exposed filament can ignite inflammable or explosive mixtures of gas in the surrounding atmosphere.

The U. S. Bureau of Mines has approved the assembly for use in methane-and-air mixtures. The flashlight also carries UL approval for Class I, Groups C and D service; including ethyl-ether, natural gas, lacquer solvents, acetone, alcohols, naphtha, gasoline, petroleum, propane, butane, benzine, and benzol. For further information write Auburn Button Works, Auburn, N. Y.

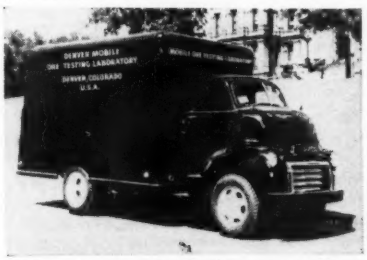
Chute Lining

A metal-backed rubber chute lining that can be used as a basic construction material and can be installed on existing or new structures has been placed on the market by Goodyear Tire & Rubber Company's Industrial Products Division.

Called Armaplate, the new product consists of abrasive resistant rubber bonded to hot-rolled steel. The manufacturer reports the steel-bonded-to-rubber technique gives Armaplate an advantage over other chute lining types because no foreign matter can become lodged between the metal and rubber bond.

Mobile Laboratory

Denver Equipment Co. has announced the Denver Mobile Ore Testing Laboratory, a compact unit that provides facilities for sampling and testing ores and the development of flowsheets for mills, tailings dumps or new deposits. The company recommends it for Governmental exploration programs or for companies

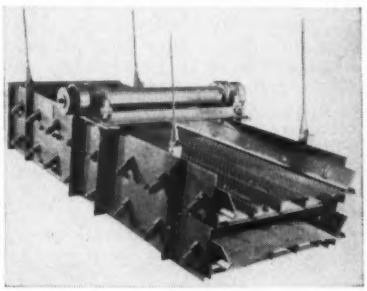


with widespread holdings. It offers Bulletin No. LG3-B11 which gives data, illustrations and a scale drawing of the mobile laboratory and includes illustrations and diagrams of the Denver Truck Mills engineered to handle flotation, gravity concentration, cyanidation and heavy media separation under field conditions. For complete information write the company P. O. Box 5268, Denver 17, Colo.

Vibrating Screen

A new "Aero-Vibe" screen (Model AVS), which utilizes a simplified two-bearing design with counterweight wheels and bolted construction has been announced by Allis-Chalmers Mfg. Co.

Built to handle a variety of feeds up to four in., and coal to six in., the screen can make separations of



from 1½ in. to 35 mesh. It is designed to handle a wide variety of materials such as sand, gravel, crushed stone, metallic ores, coal, coke, fertilizers, oyster shells, gypsum, lime, food products, chemicals, etc. It can also be used in separating solid foreign particles from liquid and solutions and for thickening, and dewatering.

The "Aero-Vibe" screen is available in suspended or floor mounted models frame mounted for portability, semi or totally enclosed, with one, two or three decks in sizes 3 by 6 to 4 by 10 ft.

For complete details ask for the bulletin, "New 'Aero-Vibe' Screen," 07B6099A, from Allis-Chalmers Mfg. Co., 972 S. 70th Street, Milwaukee, Wis.

Blast Photographers

A company with the appropriate title of Kelly-Holiday Photograph, 2765 E. Florence Ave., Huntington Park, Calif., has organized to specialize in industrial photography, including work with machine-gun sequence cameras in blasting operations. Also available as an added service are high speed 16 mm motion pictures so that the escaping gases, breakage and various patterns may be studied in slow motion to help in determining the effectiveness of blasts.

Front End Loader

The third, and largest, of the new four-wheel-drive tractor-shovels to be added to the "Payloader" line has just been announced by The Frank G. Hough Co., Libertyville, Ill.

Designated as Model HO, this unit has a capacity of two cu yd. Its outstanding features, according to the

manufacturer, are: "Pry-out" bucket action; 40° of "breakout" at ground level and new standards of safety and stability. In addition, the new HO "Payloader" features a newly developed "power-shift" transmission. The clutch pedal has been eliminated and all shifts through all speed ranges in both forward and reverse can be made without coming to a stop, the manufacturer reports.

Full details and specifications may be obtained from The Frank G. Hough Co., 846 Seventh St., Libertyville, Ill.

Vibrating Screen

A horizontal vibrating screen of completely new design has been added to Link-Belt Company's line of screening equipment.

The new screen—known as Straightline—is especially suited for dewatering high capacity loads and sizing material where headroom is limited. Link-Belt reports screen has two vibrators, one mounted on each side of the screen at deck level for ease of inspection. They do not project above the sideplates; thus headroom is held to a minimum.

Straightline screens are available in sizes from 4 by 8 ft to 6 by 20 ft with either one or two decks. Dimensions for the complete line are available on Data Sheet 2562. Write Link-Belt Co., 307 North Michigan Ave., Chicago 1, Ill.

New Crusher Manufacturer

Crusher Engineering, a new division of Poor & Co., with headquarters in Philadelphia, Pa., has been announced by the company.

The new division, will make available a complete line of jaw and roll crushers, hammermills, impact breakers, Bradford breakers and pulverizers to industrial markets. In addition, the line will include forgings and special alloyed and manganese steel castings for the maintenance and repair of these and related products.

Design and engineering of the new products will be done in Philadelphia, with fabrication to be distributed among various other divisions and subsidiaries of Poor & Co.

John Plimpton, formerly with Pennsylvania Crusher Co., has been appointed vice-president in charge of the new division. F. H. Neely, also formerly with Pennsylvania Crusher Co., has been appointed chief design engineer.

Cleaning Solvent

Development of new solvent has been announced by Turco Products, Inc., manufacturers of specialized industrial cleaning compounds.

Called Turco Solv, the agent is designed primarily for cleaning electrical equipment such as motors, generators, switches, control panels, and rheostats. Since it is non-conductive, it can be used to clean hot motors in place, often without disassembly.

Complete information is available from Turco Products, Inc., 6135 South Central Ave., Los Angeles 1.

Small Rock Duster

A new rock dust distributor, the Bantam "400," has been introduced by Mine Safety Appliances Co. The new machine will discharge more than 100 lb of dust per minute through 25 ft of two-in. hose and 30 lb per minute through 400 ft of two-in. hose according to its manufacturer. It is also available with a special nozzle to discharge wet rock slurry for fire fighting purposes.

Built low — the Bantam "400" is only 15 in. high without the hopper—it can be carried on any conveyor belt, or in a shuttle or mine car in thin seams of coal.

Full details of the MSA Bantam "400" rock dust distributor are given in Bulletin Number 1201-2, available from Mine Safety Appliances Co., 201 North Braddock Ave., Pittsburgh 8, Pa.

Cutter Bit

A new heavy-duty carbide coal cutter specially designed for undercutting and continuous mining operations under difficult conditions has been developed by Carboloy Department of General Electric Co., Detroit.

The new cutter, called the CC-5, is designed so its top is free of all obstructions, with its carbide tip positioned to protect the sides of the bit from wearing, the company reports. The tip also is designed to provide about 40 percent more holding power than other tools where the carbide extends across the top. This is due to the added brazing area provided in the shank in relation to the width of the tip.

Carboloy plans to make the new carbide cutter available in two styles. One will include a hole in the shank to accommodate the pin fastener for mounting on colmols.

Portable Cords

A complete line of portable cords for rugged applications has been announced by Anaconda Wire & Cable Co. It includes a new Securityflex cord, industrial cord and service cord.

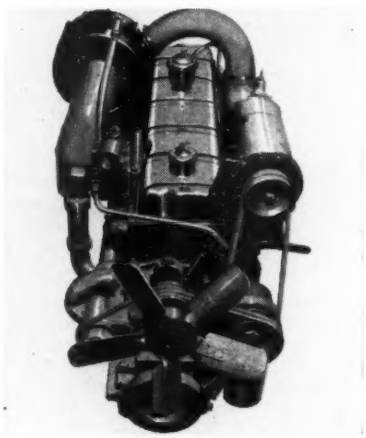
The Securityflex cord is designed for unusually severe applications, where cords are exposed to the elements and subjected to abrasion, crushing, impact, shock, moisture, oils, grease and acids. It meets the requirements of the U. S. Bureau of Mines and Pennsylvania Department of Mines for use in mines.

The Securityflex cords are available in Type SO, heavy-duty 600V, and Type SJO, light-duty 300V. Industrial cords are available in Type SO and Type SJO. Service cords are available in Type S and Type SJ, stationary and constant service.

Diesel Engine

A new lightweight, 175-hp Turbodiesel has been announced by Cummins Engine Co., Inc., Columbus, Ind. This new Turbodiesel, designated the JT-6, is a six-cylinder, in-line type with 4⅛-in. bore, 5-in. stroke and displacement of 401 cu in. Installed in a truck, the JT-6 engine weighs only 1615 lb or 9.2 lb per horsepower. It weighs 800 lb less than other Cummins diesels of equivalent horsepower, and is comparable in weight to gasoline engines of similar power.

Turbocharging is the key to the



high horsepower available from this small engine. The JT-6 utilizes the normally wasted energy of the exhaust gas to create added power. This is accomplished by piping the exhaust through a turbine causing it to rotate at high speed. A centrifugal impeller, mounted on the same shaft, but in a separate housing, draws in fresh air and blows it into the intake manifold and cylinders under pressure. The JT-6 is said to develop 40 percent more power than the naturally-aspirated model.

Uranium Prospecting Instrument

A new uranium prospecting instrument, the Model 2613 "Oracle," has been announced by its manufacturer, Nuclear Instrument and Chemical Corp., 229 West Erie Street, Chicago 10, Ill.

Sensitivity is provided by a "cluster" of ten specially treated, long-lived Geiger tubes. A feature of the ten tube "cluster" is the fact that if one or more tubes fail, it is still possible to use the instrument since a control may be used to recalibrate the Oracle to the uranium ore sample supplied.

Core Drilling Machines

Sprague & Henwood, Inc., Scranton 2, Pa., announce the development of two new diamond core drilling machines—Model 30 and Model L-2—to meet the demand for compact units which can be moved easily from one location to another and can also be relied upon to produce good cores rapidly at moderate depths.

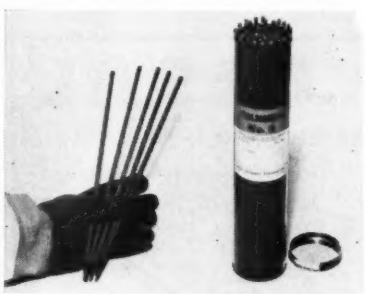
Normally skid-mounted they are also available, with an improved type of trailer mounting, for easy portability without tying up a truck. A third option provides a complete self-contained core-drilling rig mounted on a four-wheel drive truck.

Illustrated leaflets, giving detailed information and complete working data, will be mailed promptly on request to the company.

For Wear Resistance

Low hydrogen hard-facing alloy for application to working surfaces of construction, mining and aggregate handling machinery and similar heavy-duty equipment where impact and wear resistance are required is now available from Wall Colmonoy Corp., 19345 John R Street, Detroit 3, Mich.

The new ironbase chrome-molybdenum-silicon alloy, known as Colmonoy No. 2, is available for general purpose



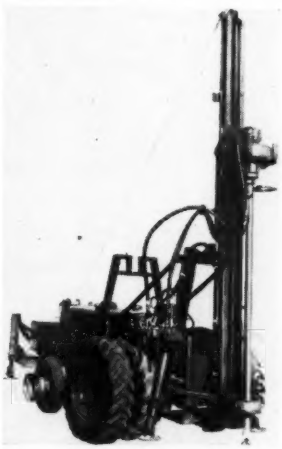
hard-facing application to manganese and other steels in the form of AC-DC electrodes.

Colmonoy No. 2 provides high abrasion and impact resistance and possesses excellent weldability, its manufacturer reports. Spatter loss is said to be low and fluidity excellent. It is not recommended for applications requiring heavy build-up where crack-free deposits are demanded.

As deposited, Colmonoy No. 2 has a Rockwell hardness of 50-55 on the C scale following the first pass and 55-60 after the second pass. Tensile strength is about 75,000 psi and specific gravity is 7.6.

Drill Rig

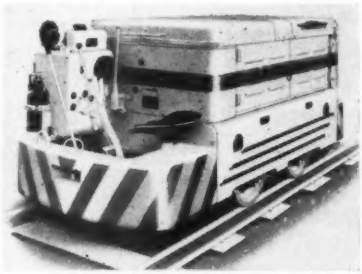
Schramm, Inc., 900 East Virginia Ave., West Chester, Pa., announces the development of a new portable drilling rig. Called the Schramm Rotadrill, it brings to rock drillers everywhere, according to the company, all the advantages of rotary rock drilling with compressed air.



Schramm reports the drill can put down a 4¼-in. hole to a depth of 500 ft and that one-man operation is possible. All controls are arranged in one bank, adjacent to the mast. For detailed information on the drill, ask for Illustrated Bulletin PR-55 from the company.

Diesel Mine Locomotives

Plymouth Locomotive Works, a Division of The Fate-Root-Heath Co., Plymouth, Ohio, announces a new line of mine locomotives to be called the Plymouth Mine-O-Motive. The locomotives are offered in sizes from



5 to 10 tons and eventually a two-ton trammer will be included in the line.

The series includes a "Permissible" model fully tested and approved by the U. S. Bureau of Mines under Schedule No. 22 for underground operation in coal mines. Suitable scrubbers and exhaust conditioners are offered on all models of the Mine-O-Motive along with diesel-torque converter drive.

Introduce Spring Dampener

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y., has recently introduced a new spring dampener for use with direct pressure clutches. Equipped with a flexible center, the new dampener is said not only to absorb torsional vibrations but also to cushion the amount of torque shock transmitted to the drive line when the clutch is engaged.

Primarily designed for use with Lipe-Rollway's direct pressure clutches for heavy-duty trucks, busses and off-the-highway vehicles, the new dampener currently is available for 10¾, 11, 11½ and 13-in. clutches.

— *Announcements* —

Joy Manufacturing Co. has appointed **L. G. Felderman** as sales manager, Rock Mechanization with headquarters at the company's Franklin, Pa., plant. He formerly was manager, sales engineering, for all Franklin products. In his new position, Felderman will specialize on trackless mining products for hard rock and tunnel applications.

Ellis J. O'Brien has been appointed manager, standard products sales, Edward H. D. Gibbs, vice-president-sales of **Heyl & Patterson, Inc.**, Pittsburgh, recently announced. In his new position, O'Brien will have charge of the sales of the standard products sold by Heyl & Patterson to the coal, chemical, utility, mining, and steel industries.

Allan R. Rowen, former sales manager of Sintering Machinery Corporation's lightweight aggregate division, has been employed by **McDowell Co., Inc.**, Cleveland, as a sales engineer and head of the lightweight aggregate section of the firm's new Dwight-Lloyd Division.

Rem-Cru Titanium, Incorporated has transferred **J. A. Manfre**, formerly Supervisor of Process Engineering and Control at its Midland Plant, to the West Coast as Supervisor of Technical Sales Service. C. I. Bradford, president and general manager of Rem-Cru, also announced that **D. R. Luster**, Supervisor of Development Engineering at Rem-Cru, would become Supervisor of Process Engineering and Quality Control succeeding Manfre.

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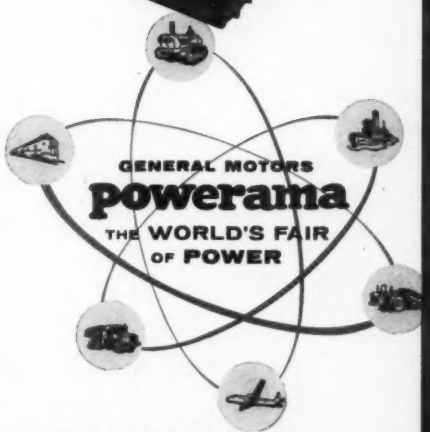
Euclid will demonstrate its complete line of diesel powered equipment. The new TC-12 Twin Crawler Tractor with a total of 388 h.p., rear-dump and bottom-dump hauling units of 10 to 50-ton capacity, and several new scrapers will dramatize the use of diesel power in mining and construction.

Plan to visit this interesting exposition — we hope to see you there!



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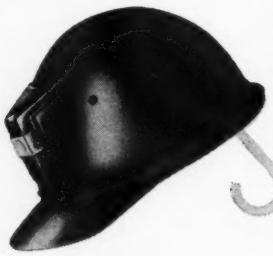
M·S·A TYPE K SKULLGARD

The most popular and accepted work hat!

Tough, laminated plastic composition safeguards workers from every head hazard. Perfect balance, light weight, results in greater wearing comfort. Available in any of the lining styles illustrated below.

M·S·A TYPE B SKULLGARD

The Type B offers the best head protection available in cap-type style. Rigid peak, with reinforced beaded edge. Accommodates all linings shown below.

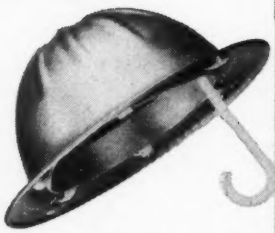


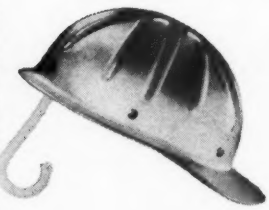
M·S·A COMFO CAP

Combining lightweight comfort with head protection, the M·S·A Comfo Cap is well-balanced, durable. Low crown designed for low coal mining. Accommodates all linings except Snap-in-Adjustable.

TYPE T ALUMINUM HAT

Light, cool and comfortable. Ideal for those desiring a metal hat. Tough aluminum alloy resists blows from falling or flying objects. Rigid brim protects face, neck, shoulders. Snap-in-Adjustable lining only.



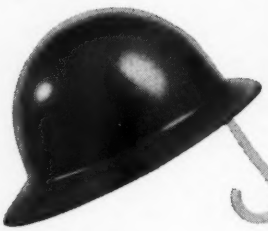


TYPE T ALUMINUM CAP

This 9-ounce protector is die-stamped in one piece from tough aluminum alloy. Balanced for comfort, well-ventilated. Snap-in lining adjustable to any size.

M·S·A SHOCKGARD

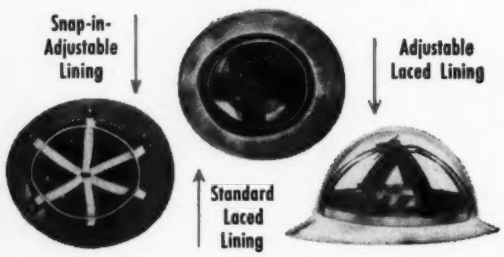
Head protection in electrical-hazard areas—from high voltage contact and falling objects. Meets EEI specifications. All plastic shell—no metal parts. Special Web Cradle straps; one-unit leather lining.



M·S·A GLASS FIBER HAT

High pressure molded, this hat provides perfect head protection. Smooth contours deflect falling objects. Snap-in-Adjustable lining. Available in stock colors—red, white, yellow, green, blue, gray, black.

A CHOICE OF LININGS, TOO



M·S·A's complete line of hats and caps meets your every job, style, color, and lining needs. They are smart-looking, lightweight, comfortable, well-ventilated. They are designed for all service conditions, and individual preferences. They are rugged, durable. Your miners are safer, better satisfied when their head protection fits the job. Write for details.

THE M·S·A LAMP BRACKET

Designed for all Skullgards, this bracket positions the lamp accurately at all times. Molded of tough plastic, the bracket retains its shape under hard service, and is not affected by moisture or age.

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When you have a safety problem, M·S·A is at your service. Our job is to help you